ELECTRICAL CONSTRUCTION AND MAINTENANCE

With which is consolidated Electrical Contracting. The Electragist and Electrical Record...Established 1901

A practical technical and management journal for electrical contractors, industrial electricians, inspectors, engineers and motor shops, covering engineering installation, operation, maintenance and management, in the field of electrical construction and maintenance.

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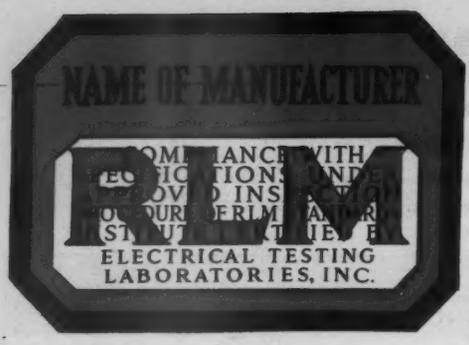

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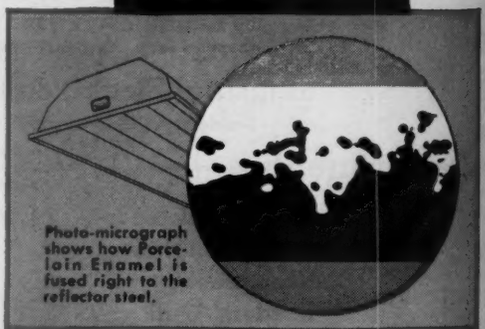

Photo-micrograph shows how Porcelain Enamel is fused right to the reflector steel.

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5,000,000 Youngsters Need Our Help Now

THE bumper wartime crop of babies, about 5,000,000 larger than the population experts expected, is reaching school age.

At school these youngsters should find a good education awaiting them. That is their most cherished American birthright.

But unless something is done quickly, millions of these children will be cheated. They will crowd into classrooms already run on double shifts. They will move in with children who are now sitting two in a single seat. They will read germ-loaded books mangled by a generation of use by grimy hands.

I

So the continuing crisis in American education is given a new twist by unexpected pressure on school plant and equipment.

The U. S. birthrate has jumped by leaps and bounds. Instead of declining in the '40s, as the experts expected it would, the rate climbed from 17.9 per thousand in 1940 to 21.5 in 1943. It jumped to 25.9 in 1947, an increase of 45 percent since 1940. Result—by 1956 elementary school attendance in the United States is expected to jump from 18,200,000 to more than 23,400,000, an increase of about 5,200,000, or more than one-fourth.

The rush has already begun. It will pick up speed next fall.

Now, while this pressure has been building up, our public schools and their equipment have been running down—first through inevitable wartime neglect, then because inflation and material and labor shortages made it difficult to catch up.

If we are to give this bumper crop of youngsters the break they deserve—and reach the educational standards the nation needs—we must speedily do a major job of educational rehabilitation and expansion.

II

Some headway has been made in overcoming the teachers' salary crisis.

Teachers' salaries are improving. Pay problems were driving good teachers away from their posts in droves not long ago. But in the year since the 57th editorial in this series emphasized that crisis, the average teacher's annual salary has increased about $300—from $2250 to $2550.

True, increases vary enormously from state to state and from town to town. In a few states the average increase has been $500; in some less than $100. But, for the nation as a whole, last year's increase put teachers about even in the race with the cost of living. After taxes, their salaries have risen 68%, and the cost of living 67%, since 1939. In terms of pay increases, however, they are not nearly as well off as are industrial workers, whose average weekly wages after taxes have risen 108% since 1939. They are far behind farmers, whose net income is now four times what it was in 1939. And teachers had notoriously low salaries to start with.

A great deal more needs to be done in raising salary standards to put our school system on a firm footing. There are still about 100,000 teachers, nearly 12% of all public school teachers, who hold temporary or emergency credentials. They cannot meet

prevailing standards, and not very severe standards at that, for persons holding their posts.

The salary crisis, however, is easing.

III

But now comes the new crisis in school buildings and equipment.

We would have been hard put to get our schools back into shape after years of wartime neglect—even without a booming birthrate complicating the problem. Right now, 85% of all public school buildings need major remodeling to remove health and safety hazards.

And we aren't building enough new schools to keep up with current needs, to say nothing of catching up on those we were not able to build during the war years. School construction expenditures for 1948 are estimated at $375 million — which is less than what was spent in 1939. With building costs twice as high as they were in 1939, that means we aren't even holding our own—we are falling further behind.

And now comes the rush of war babies.

IV

We must spend at least $11 billion on new schools and equipment in the next decade.

Public and elementary schools must have $6.6 billion. Equally important, another $4.4 billion must be invested in buildings and equipment in our private schools, colleges and universities if they are to meet the demands which will be made upon them. The private school and the privately endowed university are doing their full share and doing it well. The need for them is increasing.

These figures cover only rockbottom needs for educational plant and equipment. But statistics are a very restricted recorder of this crisis.

You can see it better, I'm sure, in schools not very far from your home. There are schools with leaking roofs and outdoor toilets in our greatest cities. There are schools where students still use histories and geographies copyrighted before 1920—books with no mention of World War I, the depression of the 1930's, the Russian Revolution or the rise of the dictators. There are countless schools where modern methods of visual education are completely unknown.

All of these conditions promise to get worse—promptly—as that scheduled 5 million increase in the school population gets rolling.

V

The Metropolitan Life Insurance Company does not indulge in lurid prose. It says after painstaking study of the educational crisis that:

"Unless definite measures are taken immediately . . . large numbers of American boys and girls will be deprived of an adequate education."

Currently we are deeply concerned about our military defenses. We are taking, and I think rightly, emergency measures to strengthen them. But we must regard our schools as a part of our national defense as vital as are our armed forces. This is particularly true in these times of fifth columns and ideological warfare.

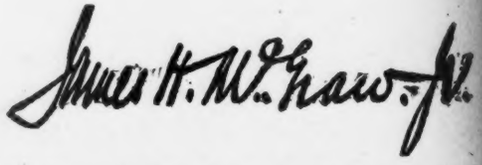
If we are wise, we will raise our sights. We will give the continuing crisis in education the same urgent attention being given the more obvious but no more real crisis in national defense.

Go to the school house in your neighborhood and discover what needs to be done to provide for the rising tide of young Americans. Ask your school board and your school administrators and teachers how you can help them.

That is good citizenship.

That is patriotism.

That is our duty to the oncoming generation.



President, McGraw-Hill Publishing Company, Inc.

THIS IS THE 68TH OF THE SERIES

JUNE . . . . at a Glance

Methods

In your next issue of E. C. & M. you will find an editorial feature section on Electrical Construction Methods. This is, as far as we know, the first time that the practical methods in design, layout, supervision and job techniques of electrical construction have been brought together on a comprehensive scale. It will be useful from several angles, as a source of practical methods, as a guide to modern job handling, as a permanent reference work. Watch for it in the July issue.

NISA

The National Industrial Service Association convention in Pittsburgh attracted the largest attendance in the history of that aggressive, growing organization. On the top of the agenda were current management and shop problems handled with a frank, realistic vigor characteristic of the industry. As usual, E. C. & M. editors were there, rounding up the program highspots for a comprehensive report and flashing pictures. The proceeds appear in the NISA Convention Report beginning on page 49. From the convention papers, "Checking A-C Stator Output" by Howard Davies also appears in this issue, page 52. Mr. Davies shows that no rotor reading is the key to maximum torque, rating and operating voltage of the motor. Comparison with locked rotor current indicates starting torque and reveals rotor troubles. Several tables give test details for various motors.

Candy

Grandma's kitchen turned out some tasty tidbits in a homey atmosphere. But professional candy making makes a better product under precision quality controls and the utmost cleanliness. Part of the reason is the electrical system of a modern plant. It is elaborate and called upon to perform many unusual chores, as well as stand up under the most rigorous housekeeping. "Wiring for Candy Making" by Hugh Scott on page 62 is the story of Fanny Farmer's large plant in New York.

Maintenance Planning

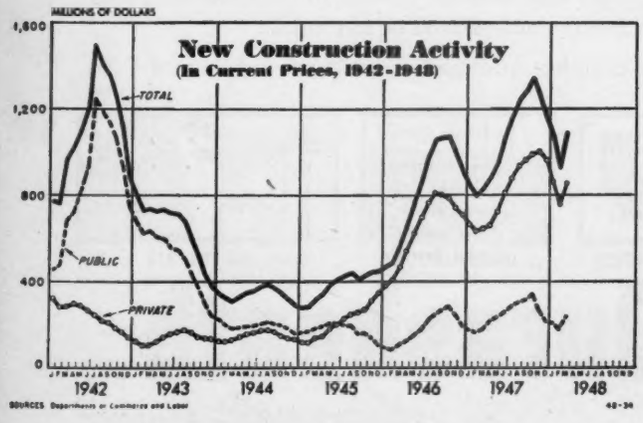
Wiring systems are vital arteries of modern production, everyone agrees. So accessibility and facilities for easy maintenance deserve a lot more attention than is usual in design. A new Detroit plant has convenience for care and repair thought out and built into the wiring system. Gus Eckel's article about the Standard Tube Company job, "Designed for Maintenance Ease" on page 54 shows how.

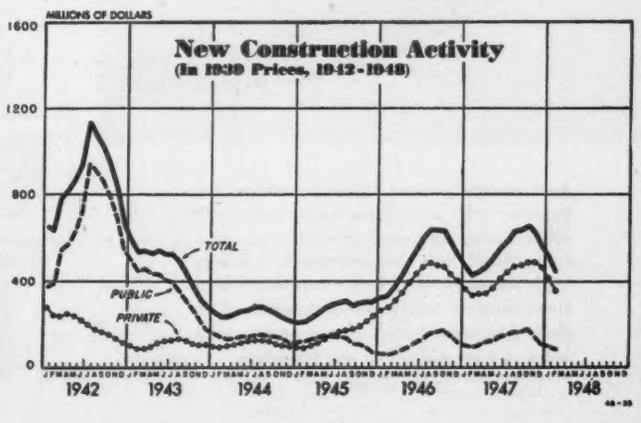
School Signal

Signal systems are as much a part of effective school routines today as the truant officer. Modern equipment is efficiently designed to meet modern educational requirements in administration and safety. A. A. Schuhler has chosen the subject of school signals for his article this month in his continuing series on signals and communication. You'll find it on page 58.

Service Stations

Time was, not so long ago, when gasoline service stations were harried with short supplies and a "customer be damned" attitude. Ample supplies, competition and courtesy are all coming back together. And the choosy motorist is giving the dimly lit, unattractive station a disastrous bypass. The power of effective lighting as a decisive factor in gasoline station competition has long been recognized. Modern planned lighting systems attract attention, encourage trade, facilitate service. A large backlog of relighting and modernization has been piling up. Effective and attractive modern techniques are available. B. C. Cooper's article, "Service Station Lighting Techniques", page 65, is an authoritative and up to date review to help you plan modern lighting installations.





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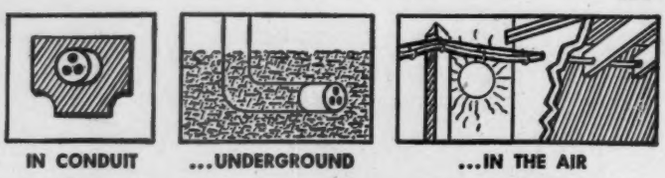

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ELECTRONIC CONTROL

ELECTRONIC APPARATUS is showing up in more industrial control. The development is sound, healthy and progressive. Glamorous, revolutionary electronic techniques are notably absent. The electron tube is applied in straightforward function, to rectify, to amplify, to switch in circuits where its unique qualities can be used to real advantage.

THERE WILL ALWAYS be a certain amount of magic in electronic devices. And industrial men are just as much impressed with the astonishing phenomena of electronics as anyone else. In considering application to industrial use, however, they are more critical. They are not amazed by circuit complexity. They are disturbed. They want rugged, certain operation and reasonably easy maintenance. They want equipment that skilled mechanics and readily available service organizations can handle and care for.

IN THREE INDUSTRIAL applications we have seen substantial growth, the controlled rectifier, induction heating and welding control. In these operations, the electron tube holds its position through no magic. It does the job more cheaply or better than other methods or it does a job that nothing else can do. For example, the tube has no competition in producing high frequencies or precision switching at high speeds.

IN INDUSTRIAL CONTROLS for machine tool or processing, however, early enthusiasm has given way to a sounder engineering approach. The electron tube is an unusually versatile device which can be made to respond with extreme precision to a great variety of stimulating phenomena. As a part of control apparatus, the tube offers the control engineer, the machine designer and the industrial electrical man a much larger horizon for ingenious, useful and economical control application. There is little logic, however, in the use of tubes for relaying and switching operation in applications that can be handled equally well and more cheaply by entirely satisfactory mechanical or magnetic components.

WITH BETTER APPLICATION and less of the glamour of electronics, electrical control using electronic tubes does not need a separate category in the control field. With better understanding and the present trend toward larger and more rugged circuit components there should be little need for specialized installation and service mechanics. Electronic controls ought to be accepted and treated as conventional apparatus. And present control trends are clearly in that direction.

Wm. F. Stuart

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NEW OFFICERS of the NISA for the coming year are: (L to R) President—Wm. S. Giles, Marion, Ill.; treasurer—H. E. Grant, Nashville, Tenn.; engineer—D. Ward Rust, St. Louis; vice-president—Fred S. Ferris, Boston, Mass.; executive secretary—Fred B. Wipperman, St. Louis; secretary—M. F. Zack, Mason City, Iowa.

N. I. S. A. CONVENTION REPORT

Largest conference in history of the organization held at Pittsburgh. Management and shop problems get top priority. Two manufacturers propose shop certification plans.

MORE than 60 percent of the membership journeyed to Pittsburgh's William Penn Hotel April 26–29, to make the Fifteenth Annual Convention of the National Industrial Service Association the largest ever held. Total registration, including women, pushed the 600 mark. Total membership is now near the 825 level. Members returned home with many new ideas on increasing shop efficiency; a better understanding of management's responsibility in our present economic setup; and the welcomed news that two manufacturers are planning to certify independent shops as their repair stations.

Attending a national NISA convention is like attending a large scale shop conference. Problems covering the whole gamut of management and shop operation are discussed and solutions are offered for the consideration of those present. To provide a greater opportunity for exchange of ideas, two afternoon sessions were devoted to informal discussion groups. At the morning meetings some 20 formal papers were presented covering the general topics of management problems and technical and non-technical shop problems.

Management Problems—This session, under the chairmanship of Fred Ferris of Boston, dealt with front office activities. Should shops be partnerships or corporations? David Sandman, Sandman Electric Co., Inc., Boston, Mass., believes that a corporation presents a more favorable set-up than partnership primarily because of the limited liability involved. He discussed the pros and cons of both and concluded that the higher tax on corporations is offset by the other advantages offered by the corporate plan, especially in Massachusetts where partnerships must pay personal property tax on inventory and fixtures.

Service facilities are becoming an increasingly important consideration when customers buy electrical equipment, stated Charles C. French, French-Gerleman Electric Co., St. Louis. Manufacturers must be in a position to offer such service or recommend a certified independent service shop. The bulk of this repair work is now being done by independent motor shops. To maintain this stature, shops must give good service and be able to repair guaranteed and over-guarantee motors at the manufacturer's factory pricing schedule, French warned. Otherwise, manufacturers will be forced to expand their own service facilities. On trouble shooting work, Mr. French believes that the labor charge should include some charge for the shop's investment in and use of testing instruments. Fees of $3.50 to $7.00 per hour are not unusual for this type of service, it was revealed.

Two manufacturer's representatives announced Certified Service plans at the convention. F. J. Geiger, manager of sales, Allis-Chalmers Mfg. Co., Norwood, Ohio, explained his company's Certified Service Procedure—a formalization and extension of a program previously handled on an informal basis. Under it, Allis-Chalmers will certify independent motor shops to repair their equipment, such agreements to be made in all areas where the industrial market warrants. A-C salesmen will recommend that customers deal directly with the Certified

H. E. Grant, Tennessee Electric Motor Service, Nashville, Tenn.; E. C. W. Johnson, Scherer Electric Co., Indianapolis, Ind.; Godwin G. Johnson, Johnson Electric Co., Staunton, Va.

C. R. Medsker, Miller-Seldon Electric Co., Detroit; James G. Spaulding, Spaulding Electric Co., Detroit.

A. O. Kleen, The Electrical Service Co., Inc., Austin, Texas; Lynn F. Hummel, Glow Electric Co., Cincinnatio, Ohio; G. E. Jones, G. E. Jones Electric Co., Amarillo, Texas.

C. Wittmer, national service manager, Emerson Electric Mfg. Co., St. Louis, Mo.; F. R. Hannon, Hannon Electric Co., Canton, Ohio; F. M. Mielke, Mielke Electric Works, Duluth, Minn.

W. L. Spraggon, Westinghouse Electric Corp., Pittsburgh; Clark Mesler, Purchase Electric Co., Grand Rapids, Michigan.

Mrs. E. J. Atkinson, The Atkinson Armature Works, Pittsburg, Kansas; George Baumgardner, Independent Electric Motor Service, Cleveland, Ohio.

Shop best able to handle their requirements. Should the customer request a service contract direct with the manufacturer, the Certified Shops will work as a subcontractor to Allis-Chalmers, Geiger revealed. He commended NISA for raising the integrity and responsibility of industrial service shops and added that most of the Certified Shops would probably be NISA members.

A similar plan is now under consideration by the Lincoln Electric Company. Lincoln would like to have independent electric motor shops repair its electric welding equipment, stated G. E. Tenney, national service manager of that company. He hopes to develop the plan to the point where the repair shops would get the profits from welder trade-ins both in the industrial and farm areas. Convention concensus favored both proposed plans and shop men are awaiting further developments.

Be certain you have adequate insurance coverage for your business organization, warned Hillrie Q. Griffith, Belyea Company, Inc., Jersey City, N. J. He outlined the co-insurance (low rate) and full coverage policies; explained the advantages and economics of each. Since insurance regulations vary in different states, Mr. Griffith advised shop operators to check over the facts with their local agents or brokers and get adequate coverage before it is too late.

Labor's present veering to the left would not have been as pronounced if management had adequately considered the human relations problem, declared Alfred Elson, Jr., New England Machine and Electric Company, Pawtucket, R. I. Single-leadership shops (non-union) should draw up a set of working rules and conditions for employees just as the unions do when they have jurisdiction in a plant, Elson stated. Such a document should include working hours, vacation periods, transportation expenses, workmen's compensation and insurances, promotion, dismissal, resignations, and company policy as to review of pay rates.

John E. Launder, Independent Electric Machinery Co., Kansas City, Mo., revealed that he posts such a set of rules in his shop and gives each employee a copy. His rules incorporate 21 specific items ranging from working hours to physical fitness and use of company property. He cautioned against inclusion of wage rates and bonus or Christmas present commitments. Once established, such regulations must be rigidly enforced or their purpose is defeated, he warned. Mr. Launder believes a general set of NISA shop rules could be developed for use in most shops.

Incentive pay plans are an important phase in successful motor shop operation. Many shops have instituted their own plan, according to reports. Discussing this subject, Frank W. Willey, Willey-Wray Electric Co., Cincinnati, Ohio, declared that *absolute fairness* is needed in any pay incentive plan. A basic fixed formula for developing correct wage rates from the "boss" on down to the janitor is a requisite, although somewhat difficult to develop. Under the American Free Enterprise System, everyone receives rewards in proportion to the contribution he makes

Charles J. Cannon, Nimmo Electric Co., Detroit; Leonce Bonnecaze, Best Electric Co., New Orleans, La.; J. J. Rick, Rick & Selleg, Chicago.

T. O. Brigham, Lind Steel Co., Pittsburgh, Pa.; Bob Kaska, Chicago Electric Co., Chicago, Illinois.

T. M. Russell, Russell Electric Co., Mobile, Ala.; M. G. Miller, Tennessee Electric Motor Service, Knoxville, Tenn.; Earl Timmerman, Pearson & Timmerman, Watertown, New York.

R. H. Giles, Missouri Electric Works, Cape Girardeau, Mo.; C. J. Covington, Dowzer Electric Machinery Works, Inc., Mt. Vernon, Illinois.

Roland B. Glines, The Roland B. Glines Co., Lawrence, Mass.; J. F. O'Connor, S. J. Leen Co., Bangor, Maine.

John E. Launder, Independent Electric Machinery Co., Kansas City, Mo.; Frank W. Willey, Willey-Wray Electric Co., Cincinnati, Ohio; Wm. J. Wheeler, The Maintenance Co., N. Y.

(work, effort, etc.). Management's basic responsibility is to know what a job is worth and see that the employee gets that pay, Willey asserted. The employer's *wrong* interpretation of free enterprise is that management can do what it wishes. That day is long past, Mr. Willey concluded.

Shop Technical Problems—William S. Giles of Marion, Ill., was chairman of this session dealing with technical problems pertinent to shop operation. A new method of bonding for metallizing shafts was announced by R. J. McWaters, Metallizing Engineering Co., Long Island City, N. Y. Known as Spray-Bond, it is a preparation that can be applied to shafts cleaned by rough turning, filing or sanding. The material makes a molecular bond with the base metal. Conventional metal spraying is then applied to the bond to build up the shaft. McWaters sees this as a definite time saver in shop operations. Discussing advances made in metal spraying, he revealed that today collector rings on rotary converters are being built up with bronze.

When repairing commutators, be sure to number the bars when removing them so they can be replaced in proper order, warned Wm. Kirkwood, Kirkwood Commutator Company, Cleveland, Ohio. To eliminate future trouble keep repair benches perfectly clean during reassembly so dirt cannot get in the commutator, he added.

The know-how of storing, dipping, handling and baking insulating varnishes was outlined in a paper prepared by F. L. George, P. D. George Co., St. Louis. The paper cautioned against using over-sized dip tanks, letting the varnish age or oxidize and urged strict adherence to proper dipping techniques and specified baking temperatures. Numerous points covered in this comprehensive review appear in the recent article "Insulating Varnish—Selection, Use and Care" appearing on page 113 of the April 1948 issue of *Electrical Construction and Maintenance.*

All motor parts are stamped with an identifying code when a motor is disassembled in the Excell Electric Motor Service shop, Chicago, Ill. Then a mechanic other than the disassembler can reassemble the unit. This was revealed in a paper prepared by Joseph F. Ferrari of the Excell Company. Also outlined, was a novel storage code. Storage sections are numbered from 0 to 9. The last numeral on the job number ticket designates the section in which motor parts are stored (Job No. 2536 would be in storage section 6).

Motor nameplates now have a "new look" according to Charles P. Potter, Wagner Electric Co., St. Louis. Explaining the new NEMA standards for motors, Mr. Potter revealed that nameplates now have a design letter (A,B,-C,D,F) which replaces former Class designations; fractionals have service factor designations; and small motors have new frame designations. Such advances are important since the nameplate is the manufacturer's guarantee of motor design and performance, he concluded.

Howard Davies, Davies Electric Motor Service, Philadelphia, presented

[Continued on page 173]

Checking A-C Stator Output

No-rotor ampere reading is key to maximum torque, rating and operating voltage of a motor. Comparison with locked-rotor amperes indicates starting torque; reveals rotor troubles

By Howard Davies
Howard Davies Electric Service and FasTest Laboratories
Philadelphia, Pa.

NO-ROTOR TEST — TABLE I
SINGLE-PHASE MOTORS

HP	VOLTS	AVG. FULL LOAD AMPERES	NO-ROTOR AND TEST AMPS 220 VOLTS	110 VOLTS	22 VOLTS
1/6	220	1.5	**9**	4.5	
	110	3		**18**	
1/4	220	2.25	**13.5**	6.75	
	110	4.25		**27**	
1/3	220	3	**18**	9	
	110	6		**36**	
1/2	220	4	**24**	12	
	110	8		**48**	
3/4	220	5	**30**	15	
	110	10		**60**	
1	220	6	**36**	18	
	110	12		**72**	14.4
1 1/2	220	9	**54**	27	5.4
	110	18		**108**	21.5
2	220	12	**72**	36	7.2
	110	24		**144**	28.8
3	220	18	**108**	54	11
	110	36		**216**	43
5	220	30	**180**	90	18
	110	60		**360**	72

NOTE: The No-Rotor Ampere readings are in bold type. Other readings are those secured when testing on lower voltages.

THE majority of motors up to five or 10 horsepower which come into the average motor shop are rated primarily on the basis of their maximum (or breakdown) torque. In most cases this figure is 200 percent of full-load torque. The power factor of a motor, which determines the current drawn, depends upon the rotor resistance, size of core and maximum torque.

Maximum torque depends almost entirely upon the stator winding of polyphase motors, squirrel cage or slip ring, and of single-phase brush type motors. It depends upon the running winding only of split-phase and capacitor-start single-phase motors. It is the basis of our winding data and the most important characteristic of the motor.

For several years we have been using in our shop a very simple means of checking stator windings for maximum torque. This is a *No-Rotor Ampere Reading* taken off the stator with the rotor removed.

This reading will tell us, in any single or polyphase motor up to 10 hp. (except series motors) very close to what the maximum torque of the motor will be. On motors from which the nameplate has been lost, it will indicate the approximate horsepower, and the proper operating voltage of the motor. A comparison between this *No-Rotor Ampere* reading and a Locked-Rotor Ampere reading will give us an approximate idea of the starting torque of the motor. The same comparative reading is also a check on such rotor troubles as bad connections, open rotor bars, and others. It will tell more about the motor than any other reading.

Taking a *No-Rotor Ampere* reading is a simple matter. First, remove the rotor from the stator. Connect the stator winding for its rated voltage. Apply that voltage to the main or running winding only of split phase or capacitor start motors; to the stator winding of repulsion induction motors, or to *one phase only* of polyphase motors. The resulting amperes is the *No-Rotor Ampere* reading.

Consider a ½-hp., 110/220-volt single-phase motor, rated at 8 and 4 amperes respectively. If we connect the stator for 110 volts, and apply 110 volts single-phase, we will get a reading of from five to eight times the full load rating of 8 amperes, or from 40 to 64 amperes. If we connect the winding for 220 volts and apply 220 volts, we can expect to get from five to eight times our full load rating of 4 amperes, or from 20 to 32 amperes.

This *No-Rotor Ampere* reading has one feature which helps our testing. It will be proportional to the voltage used. Thus, if we do not have a meter or service heavy enough to take these readings on the rated and connected voltage, nor have sufficient voltage to test 440- or 550-volt motors, we can make this test on a lower voltage. If we connect the ½-hp. motor for 220 volts, and apply 110 volts to this connection, the reading will be half of that on 220-volts, or 10 to 16 amperes.

$$\frac{\text{Rated Connected Voltage}}{\text{Test Voltage}} \times \text{ampere reading.}$$

For a 110-volt reading of 12 amperes

$$\text{No-Rotor Amperes} = \frac{220}{110} \times 12 = 24 \text{ amperes.}$$

Now consider a 10-hp., 3-phase, 220/440-volt motor, which would have an average rating of about 24 amperes on 220, or 12 on 440 volts. If we connect the motor for 440 volts, and apply 440 volts to one phase of the connections, we can expect about 5 to 8 times our 12-amp. full-load rating, or from 60 to 96 amps. Assume we get 72 amperes. If we apply 220 volts to the same connection, we would get 36 amperes; on 110 volts, 18 amperes. *It is always easier to connect the motor for the highest voltage, and use the lowest available voltage for test.* The correct *No-Rotor Amperes* still is de-

From a paper presented at the Fifteenth Annual NISA Convention, Pittsburgh.

NO-ROTOR TEST — TABLE II
THREE-PHASE MOTORS

HP	VOLTS	AVG. FULL LOAD AMPERES	NO-ROTOR AND TEST AMPS. 440 VOL.	220 VOL.	110 VOL.	22 VOL.
¼	440	0.5	**3**	1.5		
	220	1		**6**	3	
⅓	440	0.7	**4.2**	2.1		
	220	1.4		**8.4**	4.2	
½	440	0.85	**5**	2.5		
	220	1.7		**10**	5	
¾	440	1.2	**7.2**	3.6		
	220	2.4		**14.4**	7.2	
1	440	1.5	**9**	4.5		
	220	3		**18**	9	
1½	440	2.25	**13.5**	6.75	4.4	
	220	4.5		**27**	13.5	
2	440	3	**18**	9	4.5	
	220	6		**36**	18	
3	440	4.5	**27**	13.5	6.8	
	220	9		**54**	27	5.4
5	440	7	**42**	21	10.5	
	220	14		**84**	42	8.4
7½	440	10	**60**	30	15	3
	220	20		**120**	60	12
10	440	13	**78**	39	19.5	3.9
	220	26		**156**	78	15.6

NOTE: **The No-Rotor Ampere readings are in bold type. Other readings are those secured when testing on lower voltages.**

NO-ROTOR AMPERE RECONNECTION CHANGES—TABLE III
SINGLE AND TWO-PHASE MOTORS

SERIES	TWO-PARALLEL	THREE-PARALLEL	FOUR-PARALLEL
100	400	900	1600
25	100	225	400
11	44	100	177
	25	56	100

THREE-PHASE MOTORS

ONE-STAR	ONE-DELTA	TWO-STAR	THREE-STAR	TWO-DELTA
100	300	400	900	1200
33	100	133	300	400
25	75	100	225	300
11	33	44	100	133
	25	33	75	100

NOTE: **To Use Table. If motor is connected Two-Star, follow down column under two-star to figure 100. This will represent present No-Rotor Amps, or present maximum torque. Following this line to right or left will give the percentage of No-Rotor Amps, or Maximum Torque which will be obtained by changing the present connections to any other connection.**

termined by the above formula. The above results give 72 amperes *No-Rotor*, whether tested on 440, 220 or 110 volts. Note particularly, that the test reading on 110 volts with the 440-volt connection is only one-fourth that obtained with 110 volts on the 220-volt connection. Double the voltage, gives only one-fourth the *No-Rotor* ampere reading. This one fact makes it very easy to distinguish between a 110- and a 220-volt motor, or between a 220- and a 440-volt connection.

Use of No-Rotor Readings

Let us see how the *No-Rotor* ampere reading works. If a ½-hp. motor, connected for 220 volts, had a *No-Rotor* ampere reading of 12 (three times average full-load rating) it would have a maximum torque of very close to 100 percent. It would just develop full-load. Above that, it would stall. If the *No-Rotor* was four times 4 amperes or 16, maximum torque would be 4/3 of 100 percent torque, or about 135 percent. Six times 4, or 24 amperes, would give us close to 200 percent torque—the average minimum requirements for most motors. *Thus a No-Rotor ampere reading of approximately six times the average full-load rating is the figure we look for in most motors.* A *No-Rotor* of eight times full-load will show 265 percent, and so on up. We have checked motors with over 600 percent maximum torque (special applications), and this method works very well.

For most single-phase motors, 1800- and 3600-rpm., maximum torque requirements of 200 percent call for a *No-Rotor* ampere reading of six times full-load. If the *No-Rotor* is less than this, the starting torque, especially in jobs requiring high starting torque, may not be sufficient. As the *No-Rotor* amperes get up to seven or eight times full load and higher, unless it is a special motor, we begin to expect trouble. Unless the frame is larger than average, or it is a short hour motor, it will probably get too hot under load.

You may have noted that I have stressed the term *average full-load amperes.* I have found that, instead of using the full-load rating on the nameplate, if we use the average full-load rating of an 1800-rpm. motor our formula will work out best. A 1-hp., 3-phase, 220-volt, 3600-rpm. motor would probably be rated at 2.8 amperes, while an 1800-rpm. motor would rate at 3 amperes. A 900-rpm. motor might be rated at 4 and a special high torque motor at 4.5 amperes. An instance of this is the following: A 1-hp. motor was rated 4.6 amps., 30 minutes. It had a *No-Rotor* ampere reading of 52 amperes or 11 times full-load. The motor had a maximum torque of 550 percent. If we figured from our *No-Rotor* based on the rated amperes, we would have 11/3 × 100 or 375 percent maximum. Using our average rating of 3 amperes we would get a *No-Rotor* of 17 times average full load and our maximum would figure 17/3 or 565 percent, much closer to our results.

This rule has, however, a few general exceptions. If a motor has a larger than average frame, the maximum torque may be somewhat higher. Thus a *No-Rotor* reading of six times average full-load might show a maximum torque of up to 235 or 240 percent, instead of the estimated 200 percent. A motor with a smaller than average frame might give only 185 or 190 percent instead of 200 percent. Motors of 1200- and 900-rpm. tend to show a little below average, but again this seems to depend on the average size of the frame. In testing motors of 1200-rpm. and below it will be noted that, in most cases, the minimum torque requirements drop to 150 percent of maximum torque, with *No-Rotor* reading of 4-5 times the average full-load for 1800-rpm. motors of the same rating.

The *No-Rotor* ampere reading compared with the locked-rotor reading

(Continued on page 182)

MEZZANINE CONTROL center for resistance seam welders and mill motors. Bus duct feeder is above; branch conduits drop to floor at column.

DESIGNED for MAINTENANCE EASE

Circuit and equipment accessibility makes electrical system easy to maintain at The Standard Tube Company's new Detroit plant. Electrical contractor was the Hydon-Brand Company.

By August Eckel

MAINTENANCE of industrial electrical systems is an important item in every plant operating budget. Whether the annual cost is excessive, moderate or low, depends to a substantial degree upon the original system design. This was one of the prime factors that determined wiring methods used in the new Detroit plant of The Standard Tube Company, manufacturers of welded steel tubing.

Standard's electrical engineer. Ernest W. Hedges, had a taste of mounting maintenance costs in the leased building they formerly occupied. When management decided to build a new plant, he was given a free hand in designing an electrical layout tailored to their specific production requirements. That he made the most of this opportunity will be evident as this discussion progresses.

The 146,000 sq. ft. plant was designed by Albert Kahn Associated Architects and Engineers, Inc.; is served by a Detroit Edison Company 24 kv. line. Primary, 4,800-volt, 3-phase power is distributed underground to three outdoor substations. Two of these provide 480-volt, 3-phase secondary service. The third provides 480-volt, single phase service to a group of eight resistance welders on the tube mills.

Overheating and burnout of welder control electronic tubes was previously experienced when two welders were fed by a single transformer. To eliminate this, a single transformer was installed for each welder circuit. An outdoor bank of eight 4,800/480-volt single-phase units (5-150 kva.; 2-250 kva.; 1-200 kva.) serves two indoor secondary cubicles, each containing four 2-pole, fused, deadfront disconnect switches. Eight exposed, overhead, conduit feeders (one or more 500 MCM cables per leg) go from the switch cubicles to balcony-mounted welder controls.

Mill motors and other 480-volt 3-phase power equipment are served by

PLANT LIGHTING system consists of 750-watt-reflector lamps messenger-cable suspended above the steel trusses. "Smog" in background blurs part of photo.

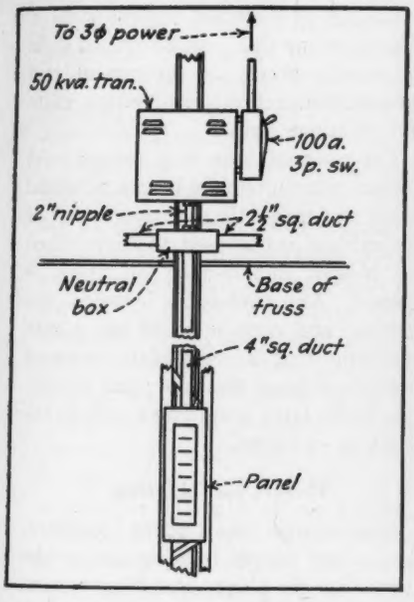
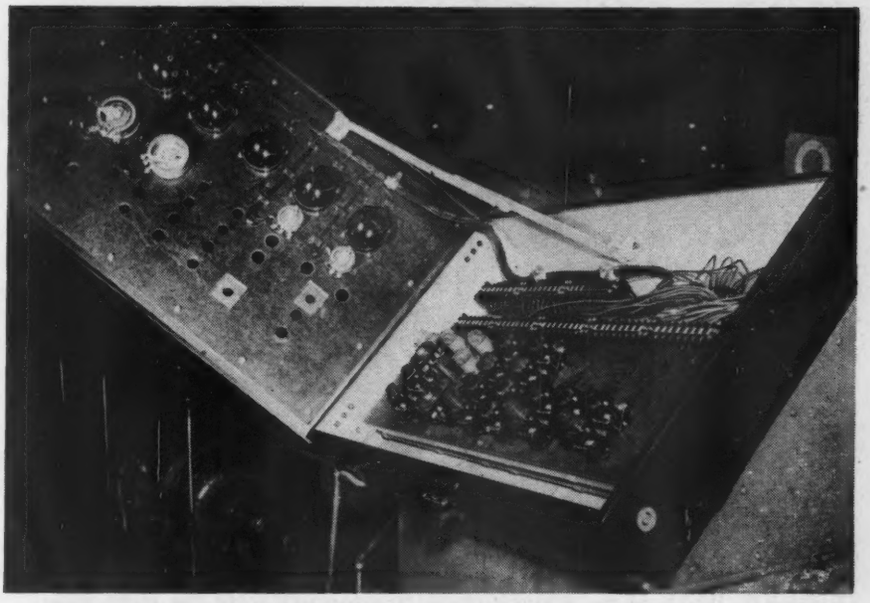


FIG. 1—Detail of panel, square-duct and transformer installation.



HINGED TOP OF CONTROL panel swings open for easy maintenance of push buttons and instruments.

two transformer banks, each with three single-phase units. In lieu of conventional switchboards, 1000-ampere bus duct is connected direct to the transformer secondary bus. Conduit feeders to motor control centers are connected to this bus through 400-ampere fused bus "plugs".

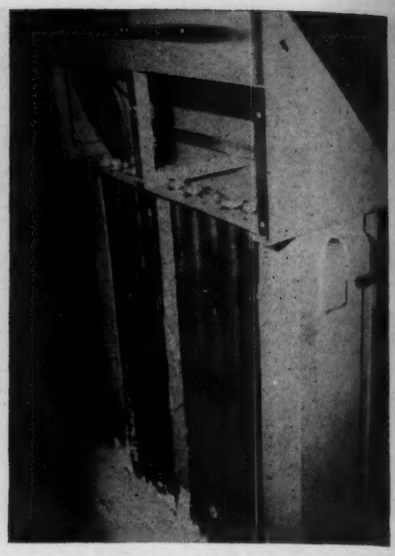
Mezzanine distribution is another feature of this installation, made by the Hydon-Brand Company. Detroit electrical contractors. All motor control apparatus is kept off the production floor by concentrating it on special steel balconies installed between building columns. Extra wide platforms provide ample working space for the maintenance electrician.

Distribution to the various control units in the group is made through an overhead section of bus duct (terminus of the main conduit feeders). Groups of conduits at the mezzanine columns carry the individual branch circuits under the floor to motor locations. Conductors from the conduit risers to individual control units are housed in the natural raceway formed by the underside of the balcony platform structure (enclosed by removable covers).

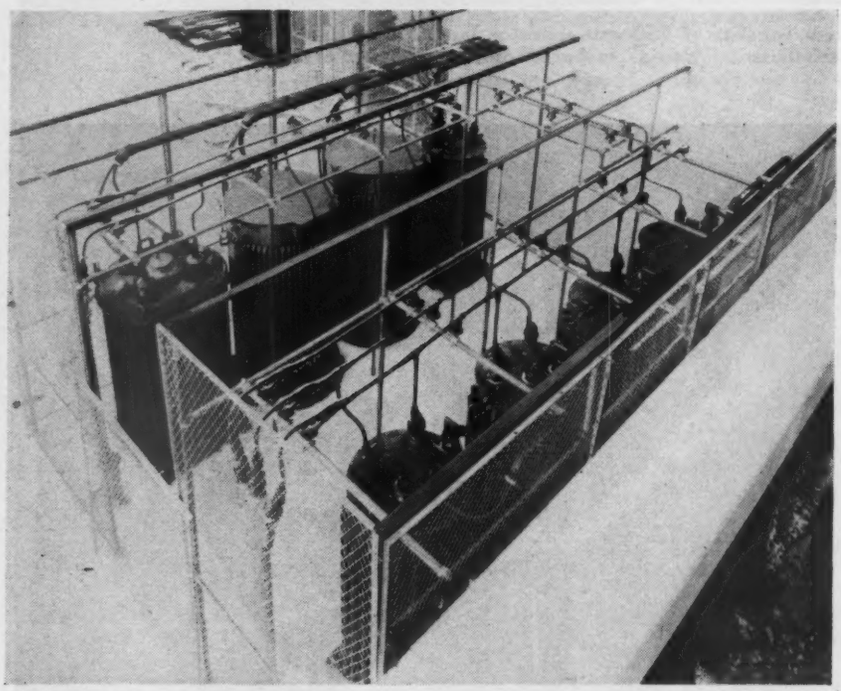
The tube mill control stations are another striking example of management's all-out attitude toward maintenance ease. Designed by Standard Tube engineers, these pedestal units are floor mounted directly behind and

UNDERSIDE OF MEZZANINE platform forms raceway for control conductors. Cover is removed. Conduits at column carry circuits to remote control.

PULL BOX EXTENSION ties welder conduit risers to a mezzanine raceway. Conduits go in floor to resistance welder on tube mill.



CONTROL STATION OVERHANG fits over conduit extensions; provides ample wireway. Hook permits crane to set or remove complete station assembly.



OUTDOOR BANK of eight single-phase transformers serve the eight seam welders on the tube mills. Each transformer feeds a single welder.

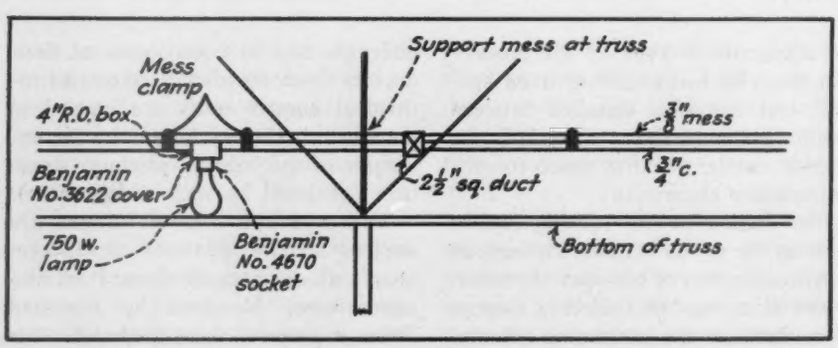


FIG. 2—Detail of branch circuit conduit support and reflector lamp mounting.

within arm's reach of the operator watching the welded seam. Every part that might ever require repair or replacement is readily accessible.

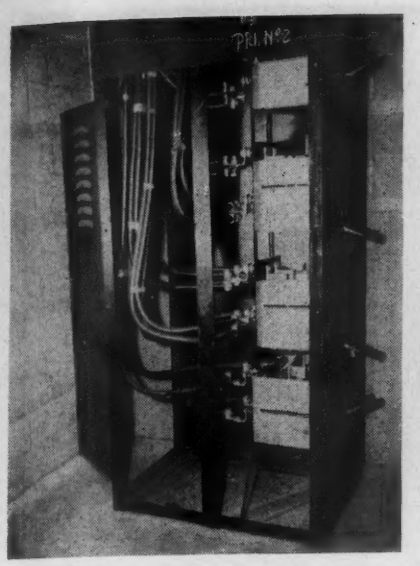
The top of the tilted control panel is hinged on one side; can be opened wide to provide access to instrument and rheostat connections, pushbutton units and terminal strips.

The pedestal base is a roomy steel cabinet containing fuse blocks, terminal strips and magnetic contactors. All of the cabinet is exposed to view when the hinged double-door on front is opened. An enclosure between the pedestal and control board has a rear overhang that accommodates conduit extensions from the floor; has removable back plates providing access to the wireway it forms.

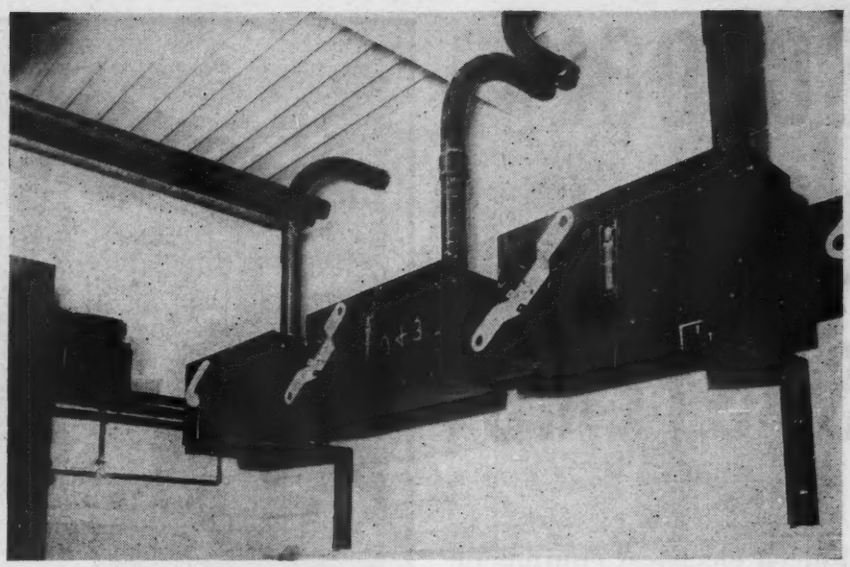
Fixtureless Lighting

Maintenance was a prime consideration in the unique lighting system designed for the plant area. Past experience recorded stiff costs for fixture cleaning in the former plant. The "smog" resulting from tube mill and forging operations would "pocket" in the high bay reflectors, coat the lamp and cut light output.

For the new plant, Engineer Hedges specified reflector lamps (with an inside-frosted bowl) mounted to shock-absorbing sockets on an octagon outlet box. Now the "smog" simply passes around the smooth lamp surface and goes up through roof ventilators. Estimated saving in fixture cleaning cost: About $10,000 annually ($2.00 per lamp per month).



ONE OF TWO switch cubicles for welder circuits. Unit has three 600-amp. and one 400-amp. 2-pole fused switches.



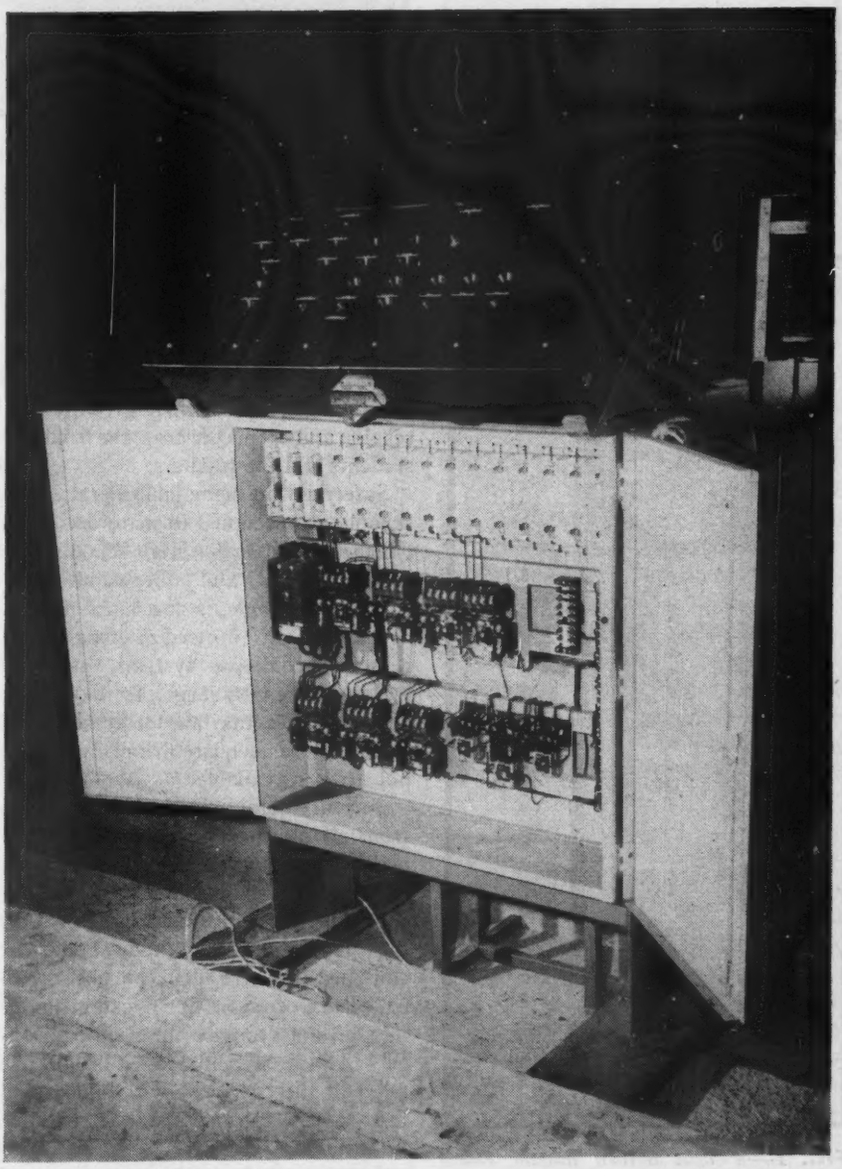
DISTRIBUTION TO MILL motor load centers is made through fused disconnects on bus duct that connects direct to transformer secondary busses entering wall at left.

Some 435 — 750-watt reflector lamps are used to light the plant area. Mounted about 30 feet above the floor (just above bottom chord of trusses) on 15-ft. by 16-ft. spacing, the lamps provide 20 footcandles of illumination on the working plane. Lamps can be serviced from the bridge cranes that travel throughout the areas.

Interesting wiring methods were used to feed this lighting layout. Lighting panels on the building columns are fed by dry type transformers mounted in the trusses and connected, in general, to the three-phase power system. Most of the lighting distribution is 110/220-volt single-phase, three-wire. A small section is 3-phase, 4 wire.

Branch circuit conduits are supported by messenger cables (on 16-foot centers) running the length of the building at a height so the bottom of the lamp is just above the bottom chord of the roof truss. Cross feeds to the conduit runs consist of 2½-inch square duct supported at messenger cable height.

At panel and transformer locations, the square duct connects to a "neutral box" above the truss base. This scheme eliminated carrying individual circuit neutrals down to the lighting cabinet. A 4-inch square duct riser connects the panel to this neutral box; carries the panel feeder from the transformer and branch circuits up to the lighting system. Throughout the plant, economies due to planned maintenance are achieved objectives, and energies of plant personnel can be directed to production.



ACCESS TO CONTACTOR CABINET in control station pedestal is provided by double doors.

SCHOOL SIGNAL SYSTEMS

Modern electrical equipment is essential to school administration and safety. This article reviews contemporary school signals and communication methods.

By A. A. Schuhler

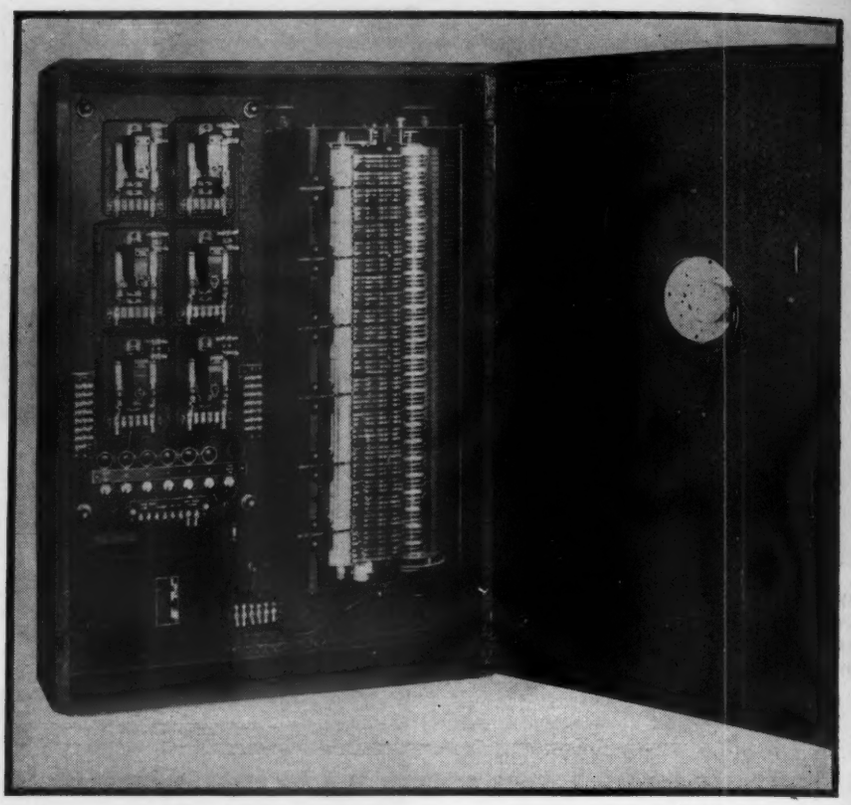


FIG. 2—Program device consists of program unit, calendar device and the signal circuit relays.

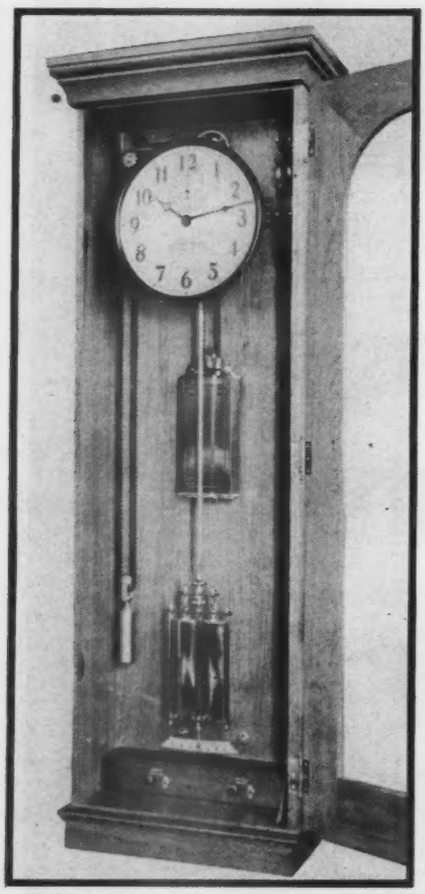


FIG. 1—Weight driven master clock with mercurial pendulum and impulse accumulator.

ALL modern schools require signaling and communication systems which will act as an aid in properly and efficiently administering such institutions. Adequate equipment properly designed and installed will give the best results and will conserve the time of students and the teachers.

Safety is the prime consideration as schools are occupied in many cases by children of all ages. High schools, vocational schools and colleges, although occupied by students of a more mature age, are equally in need of efficient and reliable protective systems, as such buildings are very large. In the case of many colleges, they are located in small towns where adequate fire protection is not always available.

Any fire signal should be distinctive from all other signals, and should be audible to everyone in the building. The apparatus for sounding the alarm should be generously distributed within the path of escape, and should be equipped for fire drill purposes. So called fire-proof or fire-resistant buildings do not decrease the need of properly drilled students, as a small fire may fill the corridors with smoke and may result in a panic and possible fatalities.

In general there are three types of systems used in schools, first, those used by the administrators or teachers, second, the systems used for the protection of all persons on the premises, third, the systems used by the students. The systems used by the administrators or teachers are clocks and program systems, sound and radio distribution, telephones, lecture call, orchestra call and dressing room call systems. The systems used for protection are the fire alarm, sprinkler alarm and tank alarm. The systems used by the students are instruction equipment such as small telephone switchboards in commercial classes, general signal equipment in vocational schools and laboratory panels in high schools and colleges.

Clock and program systems provide the means of showing correct time throughout the premises and to denote the different periods in a day's schedule. A master clock is shown in Figure 1 and consists chiefly of the movement, dial, circuit relays, pendulum and circuit switches all of which are enclosed within a case. A program device is shown in Figure 2 and consists chiefly of program unit, calendar device and the signal circuit relays.

In grade schools the programs are generally arranged to operate signals at the start of classes in the morning, morning recess, lunch period, afternoon recess and afternoon dismissal. In high

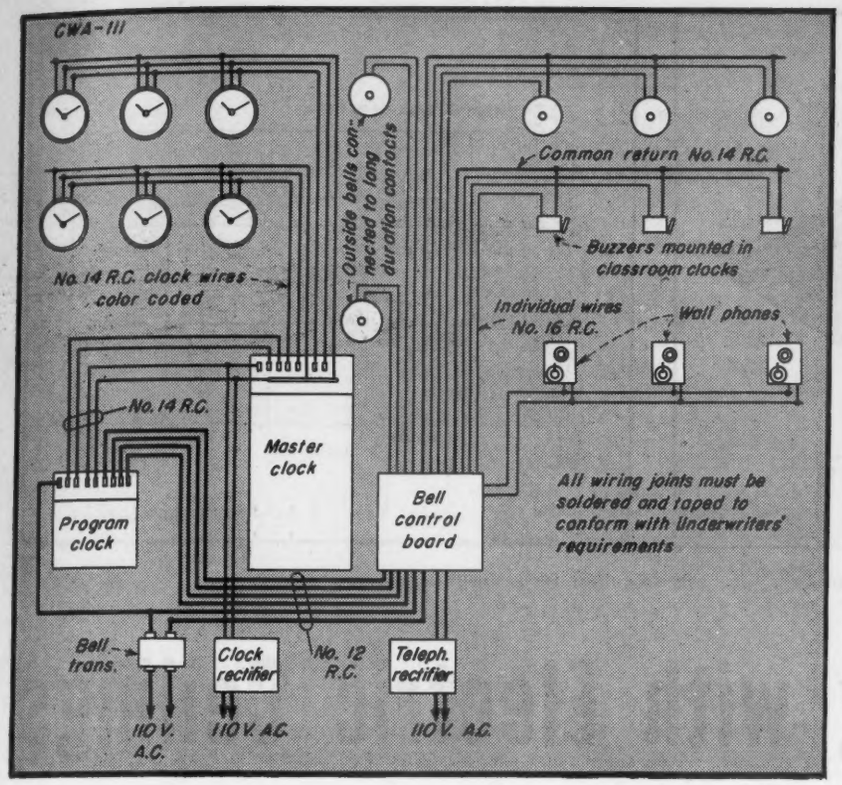


FIG. 3—Typical wiring diagram for clocks, program and telephone systems.

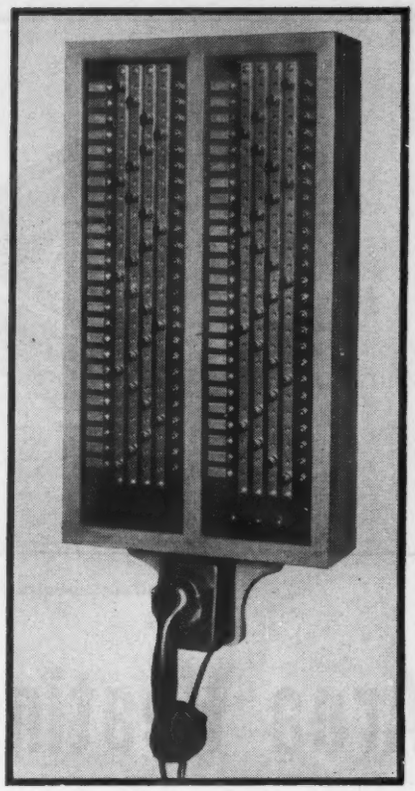


FIG. 4—Pushbutton and cross connecting board permits changing audible signals to any preset program.

schools and colleges the changes in class periods and evening classes must also be considered in setting up the ringing schedules. Program instruments may be provided for any period up to 24 hours .

The clock systems are available in three different types, that is, the d-c minute impulse, the combination a-c and d-c minute impulse and the a-c synchronous motored. In the d-c minute impulse system the master clock is operated from a d-c source of current, usually a rectifier, which in turn sends impulses to all secondary clocks once each minute. In addition the master sends out hourly correction impulses to regulate the secondary clocks. In the combination type of system two sources of current are used, the master clock operates by means of a-c synchronous motors while d-c which is supplied by a rectifier operates and regulates the secondary clocks. In the a-c synchronous motored clocks one type of system uses two motors in each clock, one for normal time, the other a fast motor for regulating time. Another system uses a clock master to control outlying clocks with single motors having an ingenious arrangement for speeding up the same motor for hourly regulation. Still another system uses single motors throughout, however, the motors are sped up by means of a frequency changer.

Program systems require means to ring the audible signals, bells and buzzers, selectively in class rooms, corridors, etc. This is accomplished by means of a cross-connecting pushbutton board as shown in Figure 4. This unit consists chiefly of a pushbutton for each audible signal and a set of program busbars with plugs which permits the changing of any pushbutton from one program circuit to another. The telephone handset shown is used for communication between the office and any other location having a telephone. The pushbuttons on the program board are used for ringing the outlying telephones.

Elapsed time clocks of various types may be secured to indicate the time taken by various phases of experiments in laboratories, or the time elapsed in sports such as basketball, football, track, swimming etc. These may be connected individually or as a part of the standard clock systems.

Sound and radio distribution systems have become very popular in all types of schools. These systems consist chiefly of a control desk, microphones and loudspeakers. The control desk may be located in some special room near the principal's office. It is composed of individual control switches for each outlying loudspeaker in class rooms, auditorium, gymnasium, athletic field etc. together with monitor speaker, microphone, record turntable, radio receiver and other control devices. The microphones are located at the control desk, principal's office and stage with outlets at other points as selected. The loudspeakers are located in the classrooms, auditorium, gymnasium, corridors, athletic field etc. The system enables the distribution of radio programs, recordings, lectures and announcements to all points selectively or collectively, and if desired may also include a talk-back feature wherein conversations can take place between the monitor speaker at the control desk and loudspeakers in any class room.

Telephone systems may be used for intercommunication between the principal's office and the main office and classrooms. This may be accomplished by means of a master system having a central telephone similar to that shown in Figure 4, in which the pushbuttons are used to call the outlying telephones, and the handset is used to talk with the outlying telephones which may be composed of handphones or other types of instruments with separate transmitters and receivers. Ex-

[Continued on page 180]

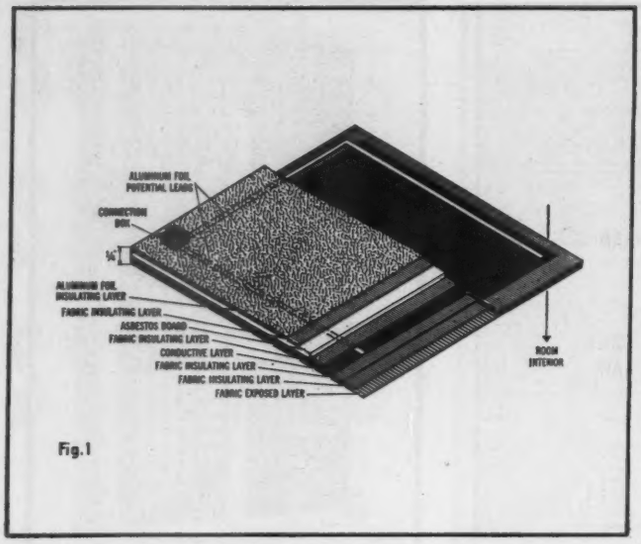


Fig. 1

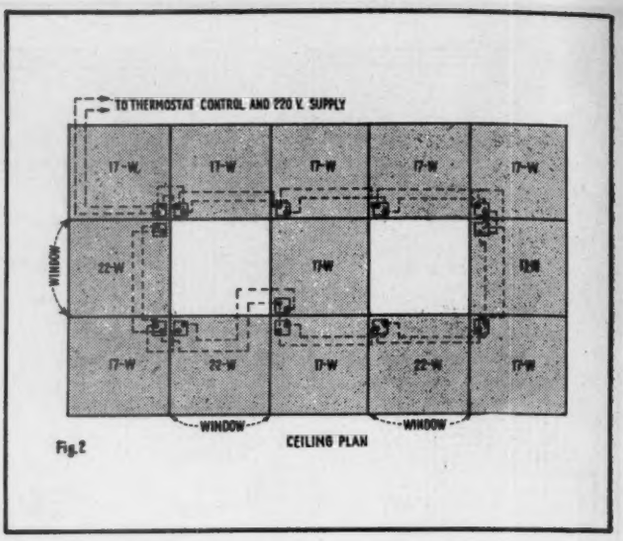


Fig. 2

Radiant heating panels . . . are installed in ceiling to provide . . .

Area Heating with Electric Ceilings

New radiant heating panels, designed for installation in ceilings, offer many advantages for electrical heating in the home, and opens up a huge new market for electrical contractors.

ELECTRIC space heating is now here for the American home. It is destined to become for the home what the electric starter has proved to be for the automobile. Its many advantages cannot be ignored. Home owners will not only pay today's premium for them—they will soon demand them.

One such system is the new Uskon radiant heating panel system developed and manufactured by the U. S. Rubber Company. It provides radiant heating without combustion from conducting rubber panels. It incorporates all the advantages of electrical energy as a heat source, plus the advantages of radiant heating.

Application of Uskon radiant heating panels to area heating is simple. The panels are merely installed in the ceiling of the room or area to be heated, and serve as both a radiant heating unit and a ceiling. The number of panels needed to heat each room, based on a degree day formula which relates the heating problem to local climatic conditions, are nailed in place and connected electrically to the heating circuit. Their operation is controlled automatically with a thermostat. Thus the panels, thermostats, circuit wiring and controls constitute the entire heating system.

The purpose of any heating system in a home is to control the rate of heat loss from the body of any individual while in the house. In homes heated with convection heating, such as steam or hot water radiator systems, this is done by heating all the air in the room to a normal temperature of approximately 70 degrees F. The radiant panel system accomplishes the same effect by direct transfer of heat energy from the heated ceiling to the people and to all other objects in the room.

The three methods by which heat is transferred from one body to another are illustrated in Fig. 3. These are: conduction, convection and radiation. Heat transfer by conduction and convection is familiar to everyone. The heating effect of sunlight is also familiar to everyone, and is the best example of radiant heat. Sunlight heats the earth, or any person or object which receives its electromagnetic wave radiation, without directly heating the atmosphere between the earth and the sun. The same principle applies to radiant heating in the home from an Uskon panel electric ceiling.

These panels are available with two different heat output ratings. One has a rating of 17 watts per square foot (58 Btu. per sq. ft.), and is used in rooms with normal heating requirements. The other has a rating of 22 watts per square foot (75 Btu. per sq. ft.), and is used in bathrooms, over large window areas, and in rooms with abnormally high heat loss. A ceiling panel layout for a typical living room is shown in Fig. 2 The panels are installed around the perimeter of the room, using 75 Btu. panels over the windows and 58 Btu. panels in all other locations. Standard building board is used to fill in the two panel areas in the center part of the ceiling not requiring heating panels.

The construction of Uskon panels is shown in Fig. 1. Each panel contains a conductive rubber layer sealed between layers of phenolic impregnated insulation. The laminated construction is made rigid by a backing of $\frac{3}{16}$-inch asbestos board. The bonded assembly, when completed is approximately $\frac{1}{4}$-inch thick and looks like any standard interior wall board. The standard size panel is four feet square, which adapts itself readily for fasten-

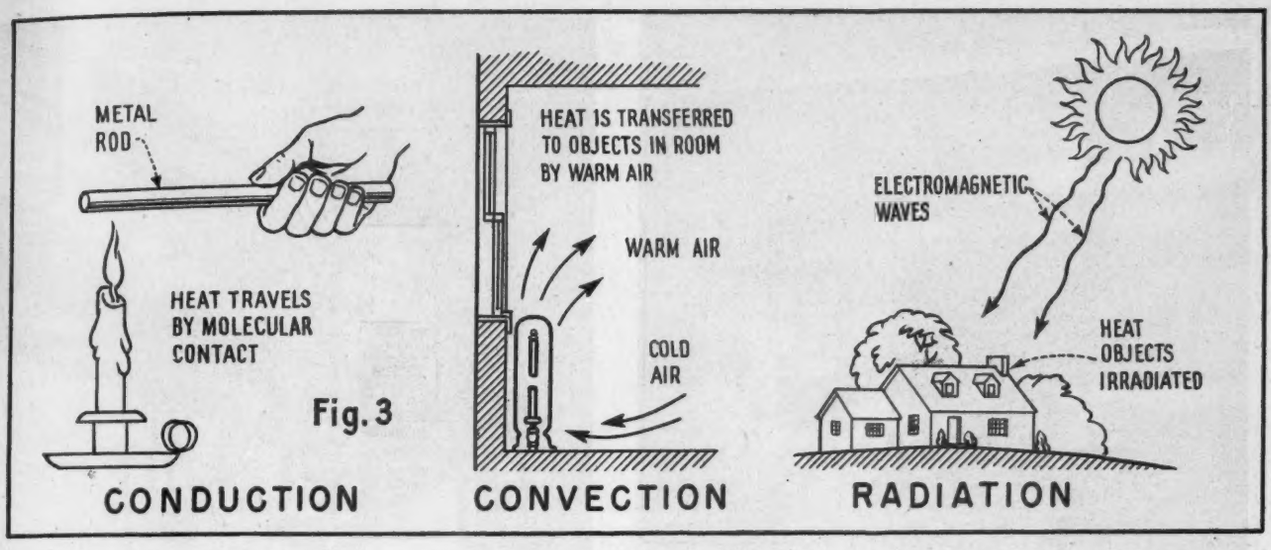


Fig. 3

. . . the three methods of heat transfer.

ing to standard 16-inch or 24-inch joist spacing. The panels are designed to operate on 220 volts, which reduces wire sizes, number of circuits required, size of control equipment and overload protection.

Wiring for the panels may be done with any approved type standard building wire. A group of panels are connected in parallel on a circuit, through a standard 4-inch outlet box furnished on the back of each panel. The circuit wires are connected to electrical binding posts which contact the rubber resistance layer in each panel by means of aluminum foil strips. The total connected load to heat the average five room house will be approximately ten kilowatts, requiring five circuits at 220 volts.

Each panel may be nailed directly to the joists through a 2-inch wide nailing margin, which is plainly marked, using standard nails. Joints between panels may be concealed in the same manner as joints between standard wall board. The panels may then be pre-treated with sizing and finished with paint, paper, plaster or fabric.

In order to provide flexibility of control a thermostat and transformer-relay control on each circuit is recommended. This makes possible temperature variations between rooms, or the turning off of current to unused rooms. Standard low voltage air actuated thermostats are recommended, having an operating temperature differential not greater than one-half degree F.

To determine the number of panels required to heat a house in any climate, the following procedure may be used. A percentage of the total ceiling area to be covered with panels is determined as follows: for *Design Temperatures* of −15 degrees and lower, use 70 percent coverage; for *Design Temperatures* of −10 degrees, use 65 percent coverage; and for *Design Temperatures* of −5 degrees or higher, use 60 percent coverage (*Design Temperature* is the lowest temperature on record with the local weather bureau plus 15 degrees F.). Divide the ceiling area (sq. ft.) to be covered by panels by 16 to obtain the approximate number of four-foot square panels. The initial cost of the installation may then be estimated by multiplying the unit price per panel by the total number of panels required, and adding the cost of wire, controls and labor for the entire job.

The operating cost for a panel radiant heating system may be approximated by the following formula: annual kilowatt-hour consumption equals 2.5 times the floor area (sq. ft.) times degree days divided by 1000. The annual kw-hr. consumption times the rate per kw-hr. equals the annual cost of heating. The number of degree days for a locality can be obtained from any local weather bureau, and the applicable rate for electrical energy can be obtained from the local electrical utility company.

TABLE I

AIR TEMPERATURE COMPARISONS

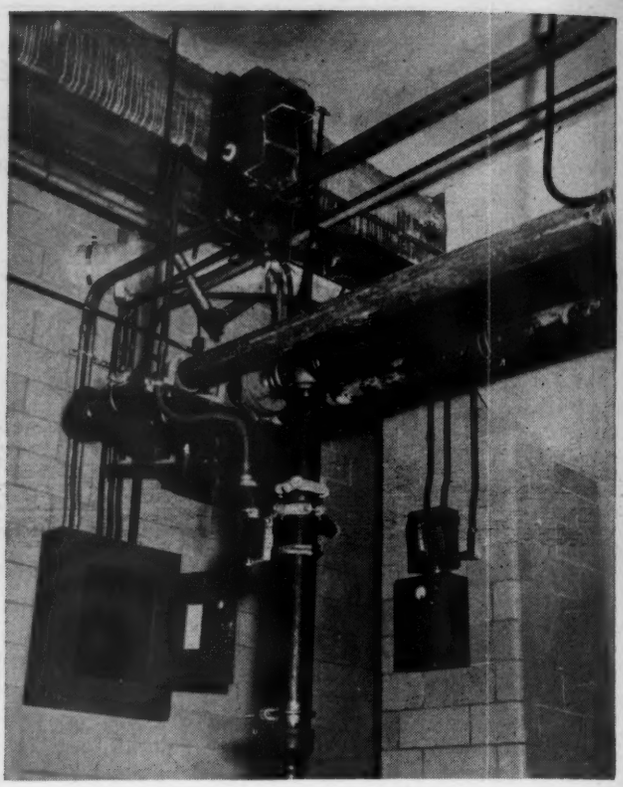
Electric Ceiling vs. Conventional Room Heating

Thermometer Location	*Electric Ceiling*	*Conventional Heating*
Ceiling	100°	75°
6 in. below ceiling	75°	74°
5 ft. above floor	70°	70°
6 in. above floor	67°	66°
Floor surface	70°	65°

The advantages of electrical heat are many. They include greater comfort and better health, reduced heat losses through walls, windows, floors and ceilings, and the removal of unsightly radiators and exposed heating equipment. It is clean, with no fuel dirt, flue gases, dust circulation, or wall stains, resulting in fewer cleaning bills, reduced painting and decorating costs. It is healthy heat, providing uniform heat from head to foot (Table I), warm floors, natural humidity and fresh air, and with less drafts, fewer colds and smaller doctor bills. It provides easy and safe operation with immediate heat, simple automatic control and individual room regulation. It has all these advantages and many more, all appealing to the American desire for a higher standard of living.

Electrical contractors should not overlook this great new phase of electrical development. The first installations of electric ceilings for radiant heating will no doubt be in the luxury homes. The advantages of electric heating will offset rapidly the resistance to higher cost. The market is almost unlimited. Contractors who believe in the future of the electrical industry will not long ignore these trends and their implications.

CONSTRUCTION VIEW, looking through self-closing fireproof vault door to free-standing main switchboard, indicates dead-front switching cubicles with all operating levers accessible from front. Meter and demand register are at right while feeder conduits, running along ceiling of basement from vault to points beneath upper-floor distribution centers, are visible at top.



CONSTRUCTION photograph of chocolate circulating lines shows new type induction heating lines which insure constant temperature and consistency of chocolate traveling from basement to first-floor dipping areas. Aquastat, transformer, safety switch and relay panel are pictured. Electrical control and personal supervision combine to maintain constant quality.

WIRING for CANDY MAKING

Vital to the modern candy studio are electrical controls, induction heating, germicidal protection, engineered wiring and planned lighting.

By Hugh P. Scott

THE production story of the modern candy studio is an electrical one. Approved wiring, electronic controls, reliable protective devices, modern lighting and germicidal air purification are major factors behind the streamlined methods which have raised achievements from a pounds-per-evening output in grandmother's day to the present-day capacities, without any changes in formulas.

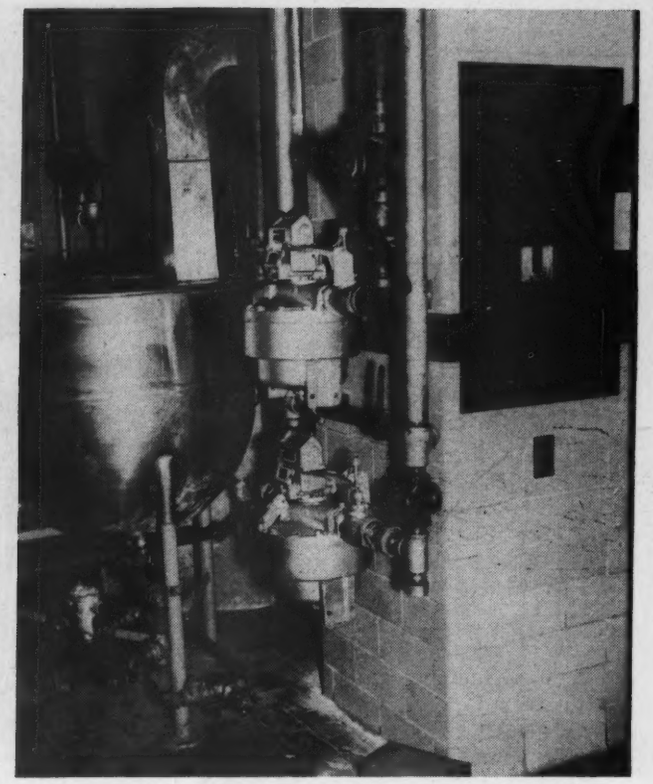
This is demonstrated in the most recent candy studio to be constructed in New York City for Fanny Farmer Candy Shops, Inc. Here, latest equipment and process standards depend upon approved electrical design and engineering, an efficient wiring installation and preventive maintenance procedures.

With custom-tailored equipment spotted on floor-plan blue-prints, power and lighting problems were assigned to electrical contractors Fischbach and Moore, Incorporated, and E. E. Driscoll, who had direct responsibility for selecting electrical equipment, planning distribution and adequately controlling and protecting the layout of feeders and branch circuits. Also included in this contract was wiring for telephones, radio, alarms, buzzer, gong and paging systems.

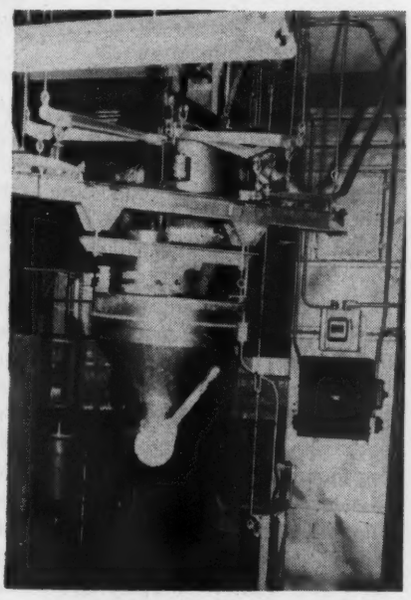
Nearly 500 circuits are in service for lighting and for the various types of heating units, pumps, compressors, conveyors, elevators and special machinery ranging in capacity from fractional to 50 horsepower. Distribution varies widely throughout the building in accordance with the requirements of offices, lunch room and kitchen, laboratories, maintenance and carpentry shops, shipping and storage space, elevators, garage and laundry areas, service and manufacturing sections.

Special attention was directed to hazardous locations, such as in the starch drying room, and unusual prob-

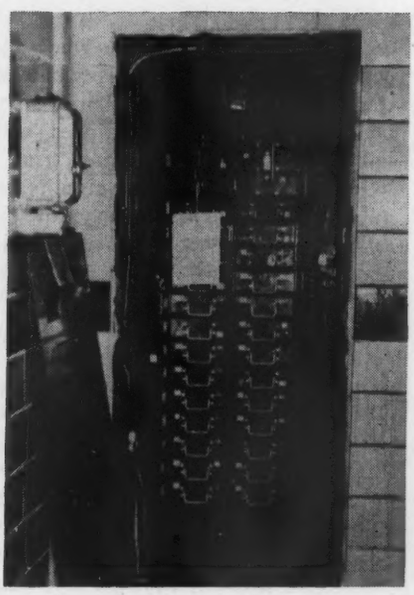
ONE OF SEVERAL TYPES of conveyor combines endless belts and rollers. Movement of belts is by means of manually-controlled motors. Interlocking controls prevent individual motors from operating independently. Other means of transportation include elevators and dumbwaiters, cranes and monorail systems, bucket hoists and wormfeed arrangements.



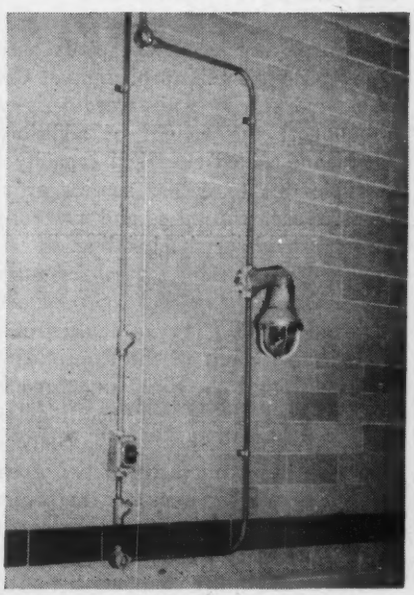
FEEDERS are carried vertically through building adjacent to structural columns. Where columns are not buried in building walls, local load centers and panelboards are mounted directly to columns and both columns and panels are framed by glazed tile. Protection and appearance of installation are improved by concealing panels and conduits in this manner.



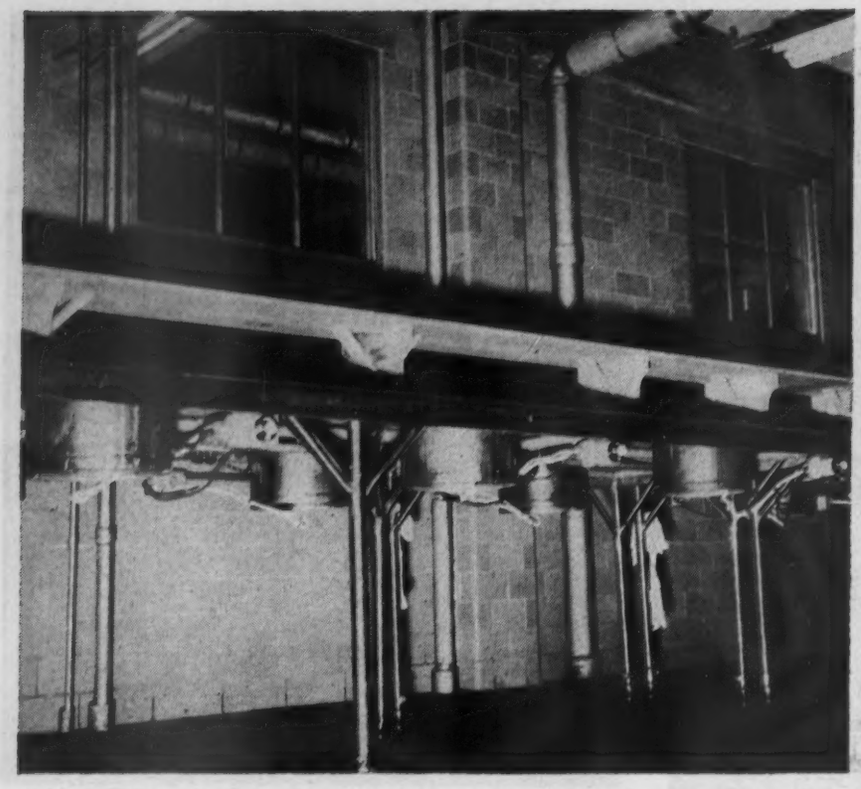
SUGAR REQUIREMENTS are handset on scale and desired amount is automatically raised from basement storage area to candy studio by means of vertical bucket conveying system, deposited into crane-mounted hopper, transported to candy kettles by means of overhead monorail, and dropped into kettle through lever-operated chute. Sugar is untouched during process.



PULL-OUT TYPE distribution panel permits electrician to make or change branch connections with complete safety and freedom of movement since circuits are automatically broken when drawers are removed for wiring. Washing of glazed tile walls by means of pressure hose is practicable since panels are protected against water by gaskets and recessed installation.



EXPLOSION-PROOF lighting units are installed in areas such as starch drying and sterilizing room. All electrical outlets and controls are waterproof. Throughout the entire plant, safety and purity are determining factors for all areas and processes. Electrical engineering and installation was by Fischbach and Moore, Inc., and E. E. Driscoll.



BON-BONS are individually dipped in electrically-heated pots and are then placed on elevated endless belt which carries candy to next operation. In all, there are 44 bon-bon pots, each one heated by 1000-watt high-low-off heating units. Picture shows under side of dipping table.

lems were presented as a result of equipment vibration and the extreme variations required for temperature and humidity. To provide for the future expansion of the studio, both structural and electrical plans were developed for this probability. Columns and bearing walls were designed to support the weight of additional floors and added electrical capacity is possible due to excess service provisions, feeder capacities and spare circuits throughout the building.

The distribution system emanates from a basement switchgear room, constructed adjacent to an underground transformer vault of the Consolidated Edison Company. Eight underground 4-inch fiber ducts, grouped together and protectively sheathed by 3 inches of concrete, connect these two areas. Only six of the ducts are in present use; two remaining for future expansion. Secondary connections, established in the utility vault, consist of five sets of three and one set of four 500 MCM VCL cables. Cubicles in the switchgear room are dead front with all operating levers accessibly positioned on front panels. A 4-pole 2000-amp. circuit breaker is provided for power while the lighting section has a breaker of 400-amp. rating. Feeders for 14 separate lighting panels and 20 power load centers are carried from the main board through 15 conduits mounted on the basement ceiling. These feeders run horizontally to points beneath upper floor panels and are then carried upwards adjacent to structural building columns. Where many heating elements are controlled as in the bon bon room, panels are equipped with indicating lamps in the panel trim.

Location of panels and circuits required care in order to maintain the unbroken smoothness of tiled walls and floor surfaces. Panels are either flush recessed into walls or are incorporated into the tiled enclosures surrounding the columns. All conduit is rigid steel and concealed. Since floor and roof construction utilizes tile between concrete joists, conduit thicknesses in these locations are limited to ¾-inch. Size 12 is the smallest wire gauge, wires of 10 gauge and larger being stranded. Type RH cable insulation is general, although RW cable in hot dipped galvanized conduit is used beneath basement floors, in the metal storage box washing room, under hoods above steam kettles and in the laundry.

By maintaining watertight integrity in the construction of tiled walls and flooring, hosing is possible when washing the candy-manufacturing areas.

Heating is an important electrical consideration in the Fanny Farmer studio, four types of heating being utilized. Office space and some manufacturing areas are conventionally heated by steam, supplied by automatically controlled oil burners and circulated throughout the affected areas by vapor risers. Differential controllers and heat balancers maintain temperatures at desired levels while low voltage control circuits connect room thermometers and balancers with burner controls. Vacuum and return pumps are also part of the electrical plan. A second source for space heating is a series of unit heaters mounted in manufacturing areas, each heater being separately switched and individually controlled with thermostats. This applies equally to heaters warming recirculated air and to those taking outside air directly, such as in rooms for bon bons, nuts and enrobing.

In addition to warming the air, it is essential that temperatures of chocolates and creams are held constant. This is accomplished through the use of 1000-watt heating units around chocolate dipping pots, bon bon pots and enrobers, and also through the use of induction heating cables running parallel to chocolate circulating pipe lines. At present, 68 units of 1000-watts each are in use. Heating chocolate through electrical induction is accomplished by using the chocolate-carrying piping as one leg of the adjacent induction circuit.

Not only is it important in the manufacture of candy to control the heat, but controlled refrigeration and air conditioning is also necessary. Roof-mounted evaporating condensers are controlled from two sources; from enclosed weatherproof switches located at condenser locations, and from basement starters remotely located near the refrigeration units. Indicating bullseyes on the basement control panel inform the operator when units are in service. For maximum protection to both refrigerating and air conditioning motors, controls for these units are interlocked. All interior air is filtered, humidified and temperature-regulated. Regulated temperatures are particularly important where ingredients are stocked. Ingredients which must be protected through temperature regulation include fresh fruits, nuts, cream, 24% fresh creamery butter and fresh eggs. Rich cream is used in place of milk and butter is received daily directly from creameries. Separate storage areas have been constructed so that

[Continued on page 179]

PUMP ISLAND LIGHTS, FLOODLIGHTS AND SIGN REFLECTORS light large area effectively (A).

PUMP INCORPORATES luminous sign and illuminated meter (B).

FLUORESCENT UNITS attached to wheel-type lift (C).

SERVICE PIT is indirectly lighted by Holophane vaportight units (D).

Service Station Lighting Techniques

Good lighting is needed to—

- Attract motorists' attention
- Provide good work light for attendants
- Provide decorative effect
- Create good impression on prospective customers

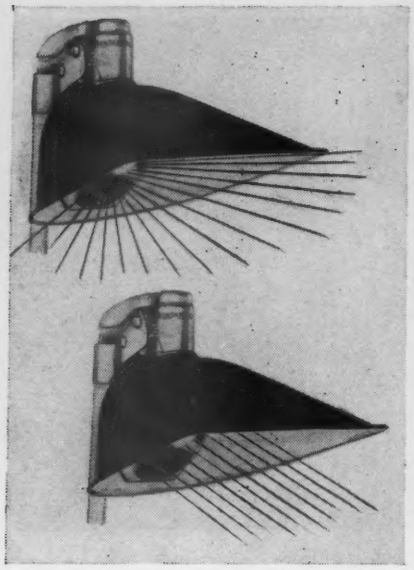
And will result in—

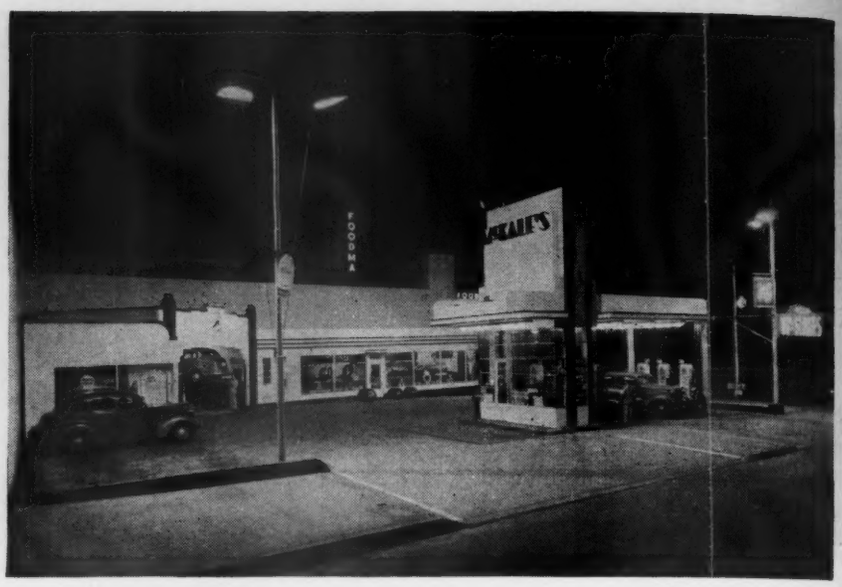
- More customers
- Greater sales per customer
- Satisfied customers
- Customer good will

Planned service station lighting attracts motorists' attention, encourages them to stop, and facilitates rapid and efficient service.

By Berlon C. Cooper

AMERICA'S 30,000,000 motorists can buy gasoline and oil from approximately 200,000 gasoline service stations. These stations range in size from the roadside "filling station" to the elaborate block-long "Service Centers". With motorists each buying an average of 1000 gallons of gasoline annually, this 30 billion gallon market, plus the market for allied products such as oil, grease, parts and accessories, repair, maintenance, motor tune-up and testing, washing, painting, etc., offers a strong challenge to each service sta-





Floodlights (E) . . . . . Light both buildings and service areas (F).

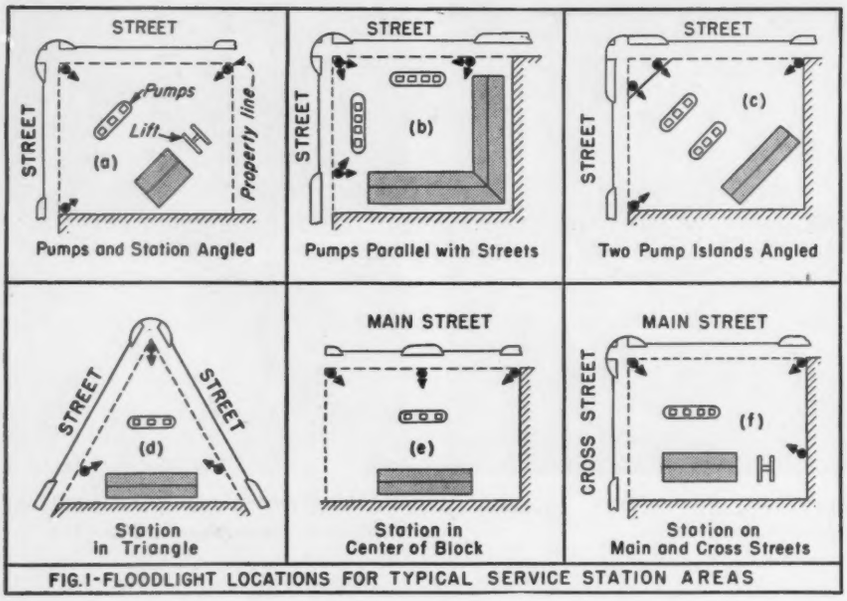


FIG. 1 - FLOODLIGHT LOCATIONS FOR TYPICAL SERVICE STATION AREAS

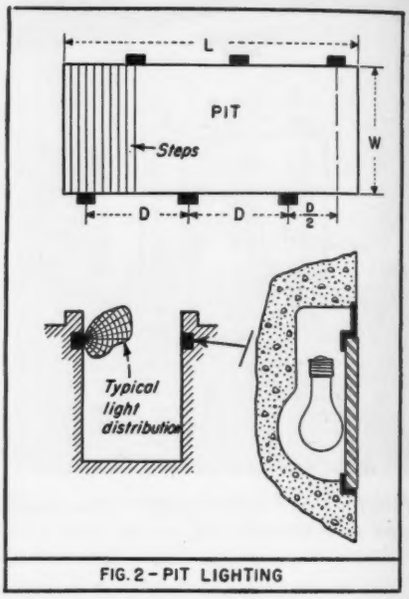


FIG. 2 - PIT LIGHTING

tion owner or manager to increase his own percentage of this available business.

A clean, well-lighted modern station, with spacious driveways and ample room for parking, is the motorists' most forceful invitation to efficient service and quality products. Planned lighting plays a major role in extending this invitation to the motorist, and in bringing him into any one station.

The principal lighting techniques used to light service stations include floodlighting, sign lighting, pump island lighting, pit and lift lighting, and canopy and building lighting. Each lighting technique plays its own part in attracting the motorists' attention to the station, and in providing utilitarian light to facilitate the work of station attendants and mechanics. Location and size of the service station guide the amount and type of light which are needed.

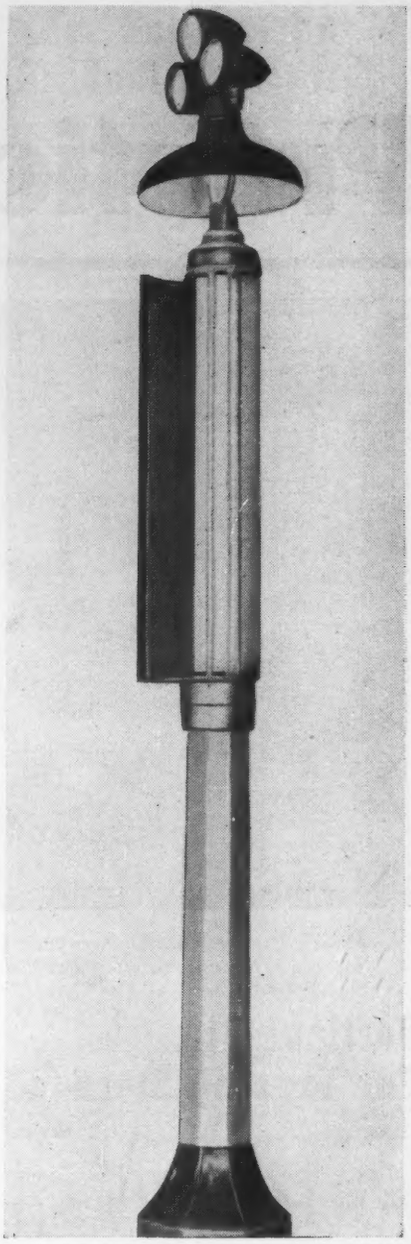
Floodlighting. Floodlighting serves a dual purpose in service station lighting. It is used to accent buildings and signs, and thereby attract attention to the station. It is also used to provide work light over driveways, pump islands, outdoor lubrication pits and lifts, and other similar areas.

Floodlight units are most commonly used for floodlighting. These units may be either open or enclosed types, installed on floodlight poles or on adjacent buildings, or may be of the ornamental type installed on ornamental standards. Luminous standards (Photo G) also attract attention to the station and provide general lighting over driveways.

Several factors must be considered in determining how much light is needed, and where floodlights should be located. Location and layout of the service station must be analyzed. If other stations or other brightly lighted buildings are located nearby, or the street is brightly lighted, ample light should be used to make the service station being lighted stand out in contrast to its surroundings. Normally, more light is required for service stations in the larger cities and on heavy-traffic streets than in smaller cities or on streets and highways on which traffic density is low.

If the station caters to transient motorists, signs and buildings should be brightly lighted, and the station should be easily identified to attract the motorists' attention at considerable dis-

Motorists are attracted to well-lighted station (G) by Luminous standards.



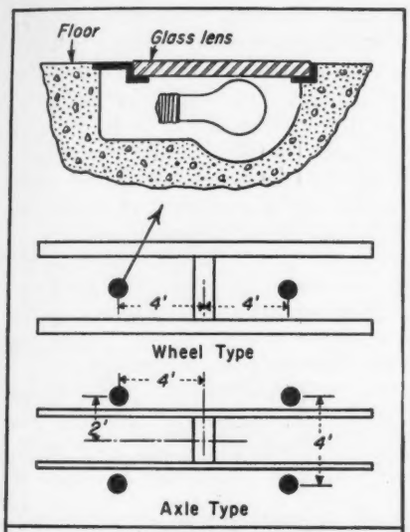


FIG. 3–LIGHTING FOR HYDRAULIC LIFTS

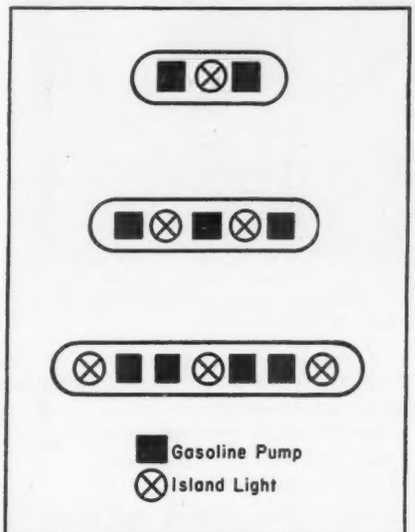


FIG. 4–PUMP ISLAND LIGHTING

tance. When local customers are depended upon for regular business, lower levels of illumination, and lighting of the more decorative type, will usually be more appropriate. The station layout and architectural design of buildings will also control to considerable extent the type of lighting system best suited.

Floodlights can be used successfully to provide high levels of vertical illumination on building fronts, signs, and gasoline pumps. This type of lighting is useful in attracting attention to the station at distances. These same units, if carefully located and beams of light are carefully adjusted, will provide a fairly uniform horizontal intensity on the driveways and work areas. Care should be used not to direct floodlight beams into the street where they cause glare for motorists, or into windows of nearby buildings. Floodlight locations for some typical service station layouts are shown in Fig. 1.

Enclosed type floodlights are preferable to open type units, as they are more easily maintained. Good quality open type units may be used successfully, however, if properly maintained. High intensity mercury vapor lamps, particularly the 400-watt size, are well suited to service station floodlighting problems, especially where pump islands are individually lighted by incandescent lamps. The light output of mercury vapor lamps is considerably decreased at low temperatures, and hence these lamps should not be used in extremely cold climates.

Building lighting. The shape, size, use and architectural treatment of service station buildings will affect the type of lighting employed. Many stations use a canopy drive-in, which affords shelter for the motorist and attendants when the weather is bad. Recessed lighting in the canopy ceiling provides good horizontal illumination over the driveway and on the pumps. Cornice lighting adds a decorative touch, and may also be used to illuminate the station's name or product brands.

The interior of the building, usually a salesroom, should have a high intensity of light near the plate glass front, and general diffuse lighting over the interior sales area. Spotlights should be used to highlight feature displays. Typical industrial reflectors are suitable for stock rooms, repair shop areas, enclosed lubrication areas or car

(Continued on page 175)

BRIEF ARTICLES about practical methods of installation and maintaining electrical wiring and equipment and up-to-date estimating and office practices. Readers are invited to contribute items from their experience to this department. All articles used will be paid for.

Practical Methods

Hirsch engineer G. K. Bernhard pulls a tracing folder out of vertical file for reference. Cabinet holds minimum of 75 folders.

Vertical File For Tracing Storage

OFFICE

Large tracings are stored in a vertical file cabinet in the engineering department of Gustav Hirsch Organization, Inc., Columbus, Ohio electrical construction and engineering firm. Advantages over the conventional horizontal drawer file: Tracings are more accessible for quick reference; more tracings can be stored; tracings can be conveniently grouped in folder according to project or job subdivision; it's easier to spot and remove desired drawings.

Overall dimensions of the steel cabinet (on casters) are 30 inches by 49 inches by 39 inches high. Movable rods mounted near the top and parallel to the cabinet length form 15 divisions or "pockets". Each pocket accommodates at least five large (44-in. wide by 34-in. deep) heavy paper folders in which numerous tracings can be placed without danger of folding or tearing. Each folder contains an identification strip on the upper right hand corner.

Mounted to the inside of the hinged cabinet cover are 18 large index cards providing space for noting the following identification data:

Classification—project name
Number—drawing numbers
Pocket—file division number
Folder—folder number in division

To remove a tracing, the large folder is merely lifted up and opened. A metal drop leaf on the front of the cabinet can be positioned so the front flap of the folder will rest on it while one thumbs through the tracings.

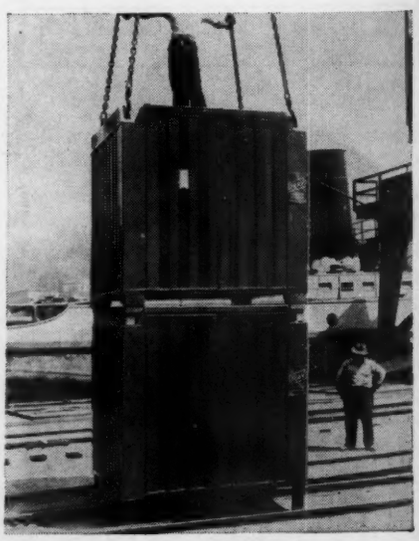
Shipping Containers

TRANSPORTATION

When the E-J Electric Installation Company of New York City was shipping equipment and materials to Mexico City in connection with the installation of the electrical distribution system for "Mexico's Hollywood" (EC & M, November, 1947), one of their problems was that of material delivery. In addition to the problems created by two separate currencies, different current characteristics, different languages and the necessity for considering operating characteristics of equipment at high altitudes, considerable material was damaged in transit, shipping containers arrived unsealed and some deliveries disappeared.

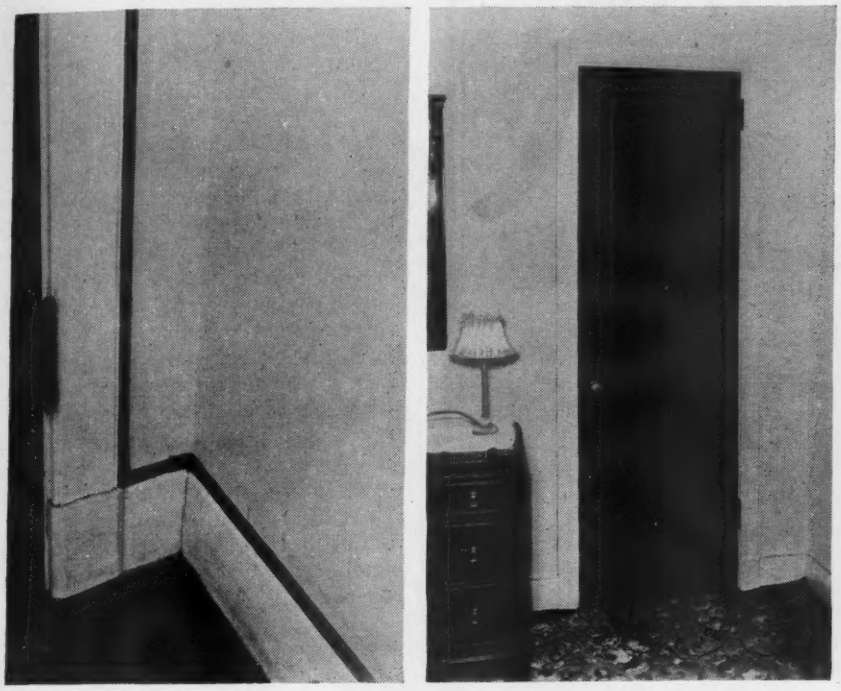
The development of a 277-cubic-foot welded steel shipping container, manufactured by the Dravo Corporation of Pittsburgh, has been stimulated by such incidents wherein contractors and manufacturers, shipping merchandise and equipment out of the country or for long distances within the country, have reported loss or damage to their shipment. Use of their interlocking weathertight shipping container is expected to solve the serious problem of pilferage, breakage and increased handling costs. The containers eliminate the need for a considerable amount of scarce packaging materials, permitting lighter packaging within the containers and minimizing the need for lumber, straw or shavings. The savings in deadweight due to lighter packaging will offset the container weight.

The containers will also permit faster loading and unloading, shippers can supervise loading on their own premises and give the carrier a locked or



Welded steel, weathertight shipping containers facilitate loading operations, minimize breakage and pilferage and also minimize packaging protection. Containers can be crane lifted or moved by fork truck. Capacity of unit is 277 cubic feet.

sealed single package rather than a group of crates and cartons. The containers interlock to fit into a minimum space, and they absorb the force of any shock or pressure exerted by other cargo. The standard container is 7 ft., 9 in. by 6 ft., 10½ in. by 6 ft., 5 inches. It weighs approximately 1650 pounds and carries a design load of six tons. Double doors form an opening 57 inches wide and 71 inches high. Being weathertight, it can be placed in the open during shipping or storage, eliminating the necessity for covered storage for its safety and its sturdy construction makes repeated use possible.



Snug to baseboard, casement and wall, ¼ by ½-inch steel raceway was installed in Cleveland's Commodore Hotel to eliminate the hazard of trailing extension cords and to locate outlets where most convenient for guests. Painted to match woodwork, the raceway blends into the trim as a decorative detail.

Surface Raceway Installed In Hotel

CONSTRUCTION

Surface raceways have been installed in the Commodore Hotel of Cleveland to improve safety conditions and increase the convenience of guests occupying the hotel's 220 suites. Approximately 20,000 feet of ¼ inch by ½ inch two-piece steel raceway was installed in providing this service. In addition to improving the appearance of the rooms, potential hazards were eliminated since wall outlets can be located strategically, extension cords can be shortened and do not have to be extended across thresholds, and structural alterations to the building were unnecessary.

Chief electrician Ray Conkel recommended surface raceway for these purposes and supervised the installation. The raceway is installed along the tops of baseboards and around the frames of doorways and windows. The small-dimensioned flat duct appears as a decorative trim around the room and, hugging the wall without casting a shadow, becomes an unobtrusive detail. When painted the same color as the woodwork, the raceway becomes a blending integral part of the trim.

To install the raceway, the base section of the two-piece assembly was first screwed to the top of the baseboards, and along door and window frames. Then the necessary lengths of wire were laid into the raceway and the steel cover was snapped into position. Outlets are now located in the most convenient positions, it was unnecessary to cut plaster to make the required installations, additional outlets can be added in the future without involving major alterations, and extension cords are now reduced to a minimum length. Construction of the metal duct satisfies Fire Underwriters and NEC provisions, providing complete safety.

Edge Scanner For Production Control

INDUSTRIAL

A new type of photo-electric control for production processes scans the edge of material as it passes along the production line; detects off-center movement; actuates a control relay for operating a correction mechanism or audible alarm. Developed by the industrial control division of the Langevin Manufacturing Corporation, New York, the device consists of two metal housings between which the material to be scanned passes.

The upper housing contains a lamp and lens which projects a broad beam of light downward to a lower housing containing two photo-tubes. Slots in the shield plates over the tubes permit only a narrow beam of light to reach the photo-tubes. Shield plates can be adjusted to permit the spacing between the two parallel slots to be varied in either direction within ¼-inch of center. When the plates are moved, the light beam through the slots moves across the cathodes of the photo-tubes. Under

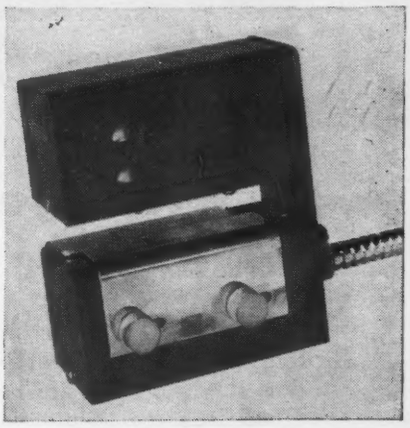
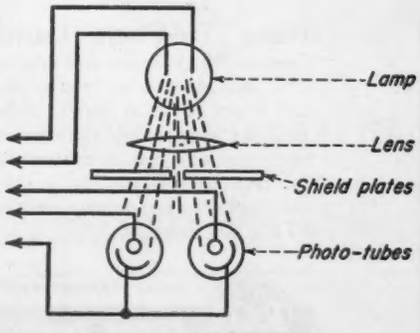


Photo electric edge scanner for use on production lines. Upper housing contains lamp and lens; lower housing slotted plates and photo-tubes. Material passes between two housings



Circuit diagrams of photo-electric scanner showing position of lamp, lens, shield plates and photo-tubes.

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RCA-892 *water-cooled power tube, directly interchangeable with 863.*

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New 16-Page Guide

Contains installation and application information on more than 260 types of RCA power tubes, voltage regulators, thyratrons, ignitrons and gas rectifiers. Ask for Bulletin PG-101. RCA Commercial Engineering, Section FT77, Harrison, N. J.

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normal operation, one slot is covered by the process material; the other uncovered. Uncovering the normally covered slot would represent a change in one direction; covering the other slot, a change in the opposite direction.

An abnormal position would be when both slots were either covered or uncovered. This would happen if the Scanner was "looking" at the edge of a sheet which moved from side to side in a lateral direction as it passes longitudinally through a machine. Movement from 3/32 to ½-inch can be detected by proper adjustment.

The unit can also be adapted for use as a go and not-go type of indicator for cutting off long sheets of paper, cardboard and other materials. When mounted on the end of a press where the leading edge of a sheet stops as it is cut off, the unit will normally have one slot covered and indicate a normal length for cutting. A long or short sheet will cover or uncover one of the slots as explained above. Cut-off accuracy can be adjusted from 3/32 to ½-inch according to the distance between slots. A press operated switch makes the Scanner active only when the sheet is stopped and in position for cutting. Used in conjunction with the Scanner is a photo-electric relay comprising two amplifier relay circuits on a common chassis.

I-Beam Supports For Power Lines

CONSTRUCTION

When the Congoleum-Nairn plant at Kearny, N. J., was recently expanded, one of the new buildings was erected in an area which was formerly used as a right-of-way for the plant's primary pole-mounted distribution system. Since the majority of the cables by-passed the new building, it was decided to carry the distribution system along the exterior wall of this structure, maintaining the original mounting height and duplicating, if possible, the arrangement of cables on the crossarms of the mounting poles which were left standing at either end of the new building. This was accomplished by using 6-inch I-beams and standard insulators. I-beams were bonded to the reinforced concrete building columns by angle irons and hooked anchor rods. On the upper beam of each two-beam installation, six 900 MCM cables are carried. Above the lower beam, six 750 MCM cables are carried. These cables are waterproof and carry a-c at 550 volts, 3 phase, 3 wire and 60 cycles. Beneath the lower I-beam, two 500

Not only is it easier to handle and pull—it's a big load off your shoulders—and a big chunk off customers' costs! They're learning this—as 13,666,908 Alcoa sales messages in national and industrial magazines sell the lighter weight and lower cost of insulated aluminum wire and cable.

Insulated wire and cable with Alcoa E.C.* Aluminum conductor is lighter. A 500,000 *cm* insulated aluminum cable, for example, is less than half the weight of an identical copper cable. No wonder it's easier to install!

Wire costs are startlingly lower, too. Bills of materials show savings of thousands of dollars when big jobs are *figured in aluminum.*

Alcoa makes light, strong, conductive E.C. Aluminum, which leading wire and cable manufacturers draw, strand and insulate, and sell under their own trademarks. Ask your wire and cable supplier about it. ALUMINUM COMPANY OF AMERICA, 2197 Gulf Building, Pittsburgh 19, Penna.

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FOR ELECTRIC WIRE AND CABLE

POWER CIRCUIT TRANSFORMERS

THE most economical way of providing low voltage circuits for the lighting and operating of machine tools is to run a branch line from the power line, using a transformer to step down the voltage.

Dongan Transformers are being used for this purpose in industrial plants throughout the nation, reducing installation time and also conserving critical materials.

•

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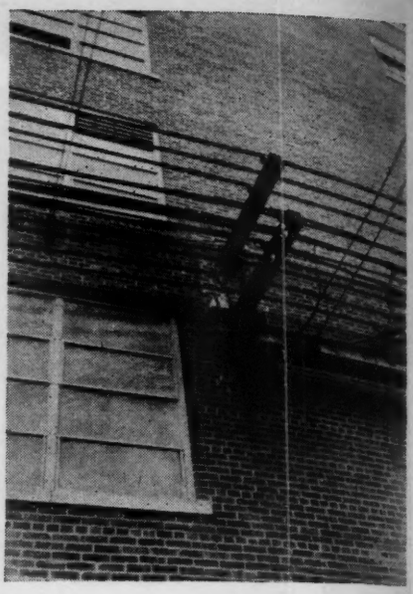
DONGAN TRANSFORMERS



To support primary distributing cables on the exterior of a new building at the Congoleum-Nairn, Kearny, N. J., plant, 6-inch I-beams were bonded to the reinforced concrete building columns by angle irons and hooked anchor rods. Taps are made to these cables and are either carried through bearing walls by means of WP service entrances or are connected to direction-changing I-beam-supported branch lines.

MCM cables are carried for distributing d-c to the various plant properties.

At points where this primary service is carried into the new building, three of the 750 MCM WP cables are tapped and are carried into the building through a waterproof service entrance. Where changes in the direction of the distribution line are required, and at points where taps are necessary to supply other buildings, additional I-beams are bonded to the building's surface and, between these beams, the terminal fastenings for the new lines are secured. By using this method of supporting the primary cables, a minimum amount of relocation was necessary and the cables are safely mounted at the third-floor level, the level where unit transformers are mounted inside the various buildings for local requirements. In charge of the entire electrical installation was L. C. Fund of the Paul Jaehnig electrical contracting organization in Newark, N. J.

Linen Taped Cables

Improvisations are still necessary as indicated by this one of the Pacific Electrical & Mechanical Co. Inc., Los Angeles, T. F. Ambrose, electrical superintendent. It is in connection with a

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can profitably use one or more of these ROTARY IMPACT TOOLS

NO KICK
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EVEN ON THE TOUGHEST JOBS

AMAZING all-purpose ELECTRIC TOOL will

- Drill up to 1/4" dia.
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- Drive Screws up to 3/8" dia.
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- Bore Wood up to 29/32" dia.
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What other electric tool will permit you to do these tough operations without any kick or twist to the operator? Plug it in any wall socket—it is reversible with full power in either direction—it weighs only 6½ pounds, but what an amazing tool for getting all those jobs done!

Ideal for installation crews—one manufacturer has equipped his installation crews with IMPACT Tools and attachments. Now, in place of 3 or 4 electric tools they carry only one and also save from 10 to 20 percent of the installation time.

Don't hesitate, call your nearest distributor now for a demonstration of this labor saving—time saving *all purpose* IMPACT Tool. They're available for immediate delivery.

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Briggs Stadium, where the Detroit Tigers cavort when at home, recently was equipped with a new lighting system, installed by the Brooker Engineering Company of Detroit, using General Electric Equipment. Its eight towers and 1,458 lighting units of 2,750 watts will provide illumination, according to G. E. Engineers, equal to that of 6,000 full moons.

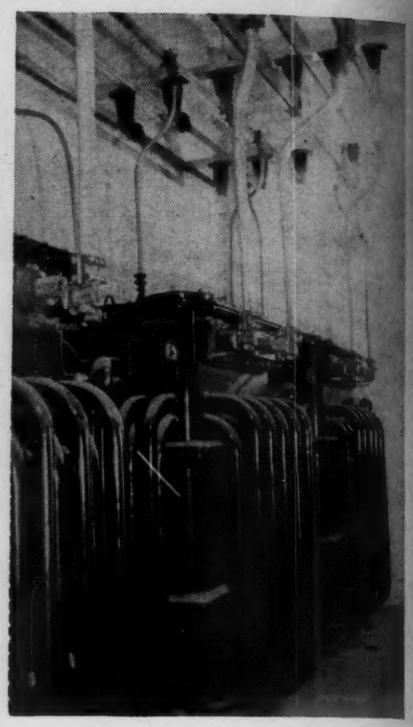
For insulating and protecting the hundreds of important wire splices which will be subjected to all the extremes of a versatile climate—rain, snow, hot sunshine in summer and sub-zero weather in winter—the contractor chose No. 33 "SCOTCH" Electrical Tape with Vinyl Plastic backing. The choice was dictated by the ability of No. 33 "SCOTCH" Electrical Tape to stand outdoor conditions, and its long aging life. Most of the electrical installation work at the Briggs Stadium was carried on in cold weather. When the above picture was taken it was five below zero in Detroit, but the No. 33 "SCOTCH" Tape retained its pliability in spite of the low temperature.

Eliminate service interruptions and excessive maintenance costs, protect your lighting and signal systems from heavy rain and corrosive fumes; wrap all splices and wire harnesses in an impervious sheath of moisture proof, oil proof, abrasion resistant No. 33 "SCOTCH" Electrical Tape. Write for a sample to try in your work.

No. 33 SCOTCH BRAND Electrical TAPE

ANOTHER 3M COMPANY PRODUCT

Made in U.S.A. by MINNESOTA MINING & MFG. CO. St. Paul 6, Minn.



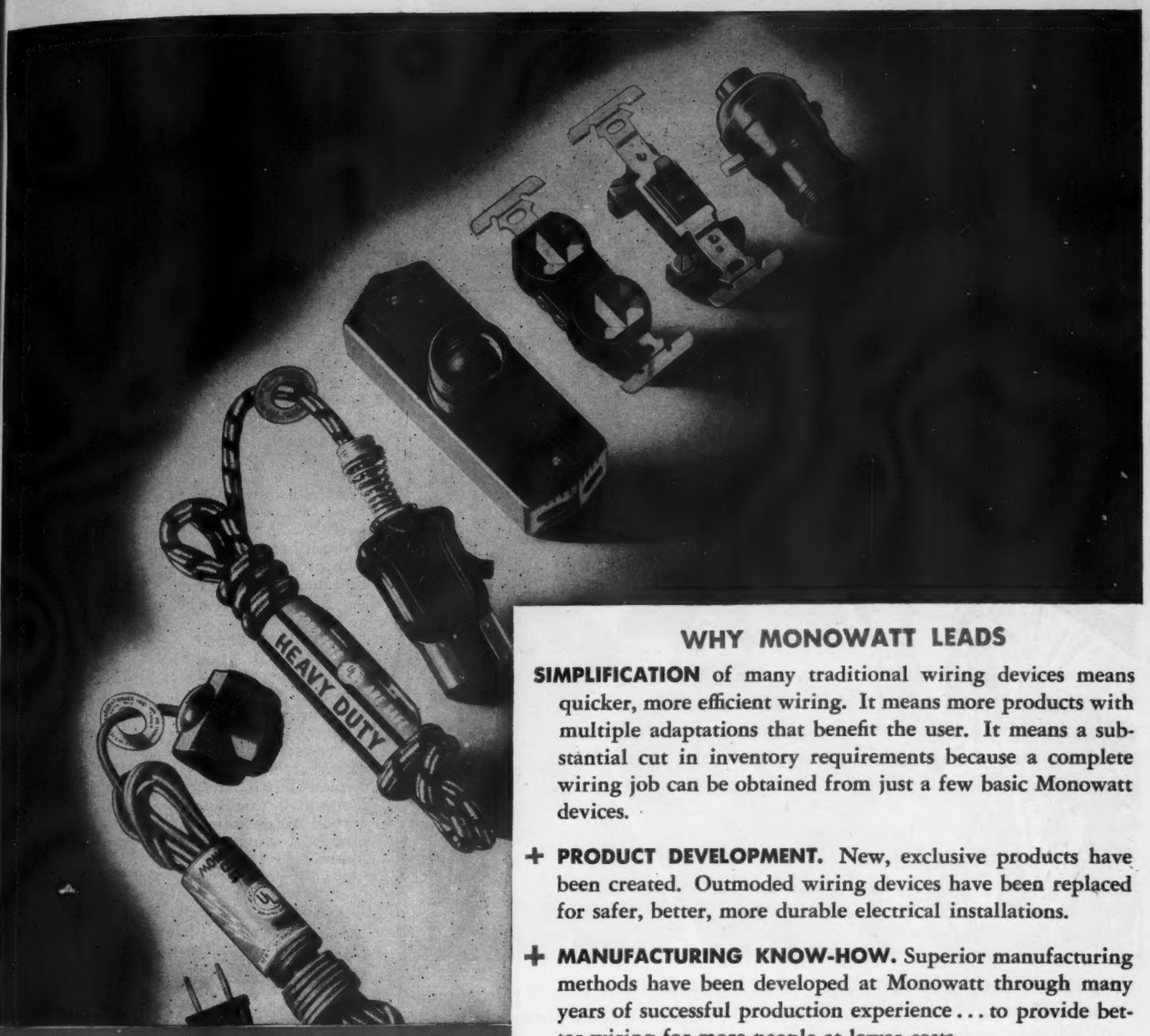
A neat-appearing installation using cables.

large, new addition to plant of the Byron Jackson Pump Co.

Among other things, Pacific installed a new transformer bank, a part of which is shown in the photograph. It has been impossible to obtain the type of flexible joint necessary to connect vertical copper busses with the transformer terminals. This being the case, Ambrose used cable instead of the rigid busses, connecting with cable clamps.

On the 440 volt secondary side, two 1,000,000 CM cables were used in parallel. The insulation was stripped off and the two cables, side by side, were wrapped with ten layers of oil linen tape as a safety feature. The result was a flat, bus-like appearance, very neat and workmanlike. On the 2300 volt primary side, 500,000 CM single cables were brought down.

C. Wittmer (center), national service manager, Emerson Electric Mfg. Co., St. Louis, discusses service policies with A. Wenger (left) and W. J. Quinn of Ace Electric Motor Service, Inc., Philadelphia, Pa.



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WHY MONOWATT LEADS

SIMPLIFICATION of many traditional wiring devices means quicker, more efficient wiring. It means more products with multiple adaptations that benefit the user. It means a substantial cut in inventory requirements because a complete wiring job can be obtained from just a few basic Monowatt devices.

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+ **MANUFACTURING KNOW-HOW.** Superior manufacturing methods have been developed at Monowatt through many years of successful production experience . . . to provide better wiring for more people at lower costs.

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THE CONTRACTOR WANTED a cable for jobs where extra quality is a "must" —a lightweight and flexible cable for easy pulling and clean, fast work.

The result? Super PVX*

Super PVX is a top-quality cable for those difficult jobs where easy installation and long service under the worst conditions are important. The tough, rotproof thermoplastic insulation and reinforcing glass braid result in smaller over-all dimensions and substantial reduction in weight.

Super PVX
NONMETALLIC SHEATHED CABLE

The smooth, durable thermoplastic rotproof sheath is available in ivory or brown color, to give trim, neat appearance on surface wiring jobs. And, it's as tough as it is good looking, to provide ideal protection from abrasion, moisture, flame, corrosive vapors, and fumes. It is approved by Underwriters' Laboratories, Inc.

For samples, see your General Electric Construction Materials distributor, or write to Section W6-618, General Electric Company, Bridgeport 2, Connecticut.

GENERAL ELECTRIC

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STILL DOING A GOOD JOB is PVX nonmetallic sheathed cable. This cable is light, small in diameter, and more flexible than conventional cables. These features are the result of skilled engineering in cable construction. They are built into PVX to give you easy handling, to speed installations, and to keep PVX on the job after it is installed. Let us give you more information on this outstanding cable. You'll find many uses for it.

DON'T WORRY ABOUT OIL—General Electric's Type TW wire doesn't. This thermo-plastic building wire has the ability to resist oil year after year, even when immersed in it. And, it's equally unconcerned about moisture and most chemical vapors or fumes.

EASY INSTALLATION—This service entrance cable can normally be installed exposed directly on the outside of the building. Service entrance cable is one of many items described in the new General Electric catalog, *Building Wires, Cable and Cords for every purpose.* If you would like a free copy, write to Section W6-618.

DON'T OVERLOOK this sales potential—The next time you call on an industrial customer, look around and you'll notice dozens of uses for Flamenol* cords. Notice the variety of equipment that requires replacement cords. It's a good way to pick up extra business . . . and add to your volume and profit.

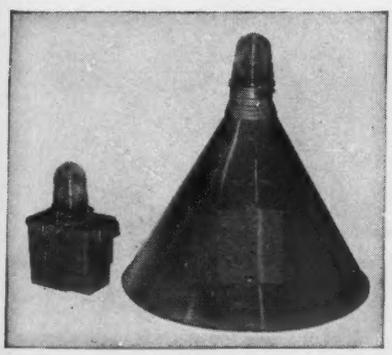
General Electric also makes rubber-jacketed cords in many sizes and constructions. They're built for long service and outstanding performance. Ask us about Flamenol or rubber-jacketed cords; we'll be glad to tell you more about them.

*TRADE-MARK REG. U.S. PAT. OFF.

Equipment News

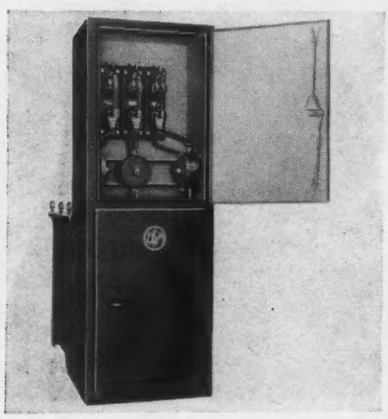
Pressure Switches

A new line of small size pressure switches designed primarily for use with motor driven home water systems has been announced. One switch type developed has an external range adjustment for adjusting operating pressure on certain types of water systems to meet seasonal changes in pressure requirements. The second switch type is without external range adjustment. It has a slotted range adjustment screw and slotted differential adjustment screw located in the enclosing case for ready access. This switch is used on installations where operating conditions are uniform throughout the year. They are designed also for use with small compressors, oil pumps or any motor driven pump on a pressure system. Cutler-Hammer, Inc., 228 North 12th St., Milwaukee, Wis.



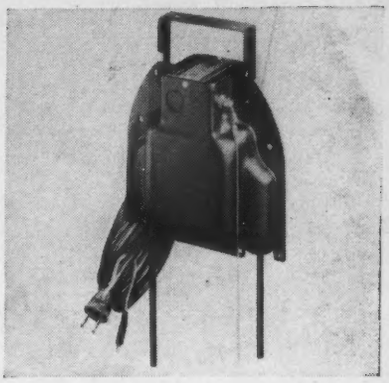
Marker Light

Flashing portable marker lights suitable as airport obstruction indicators or for marking temporary hazards on streets or highways have been announced. Two types are available. One is a portable marker light for nighttime use only and the other in which the light source is mounted on a large, visible cone finished in international orange, is effective for both day and night use. Coiled neon-tube type lamps are used in both types of lights powered by a standard, dry-type Hotshot battery. For obstruction marking, a red lamp is used. For other applications, white, gold, green, or blue fluorescent-type lamps are available. Marker lights can be used at airports to outline or identify temporary obstructions within the usable landing area such as soft spots on runways and landing strips, new construction work, or damaged aircraft. Other uses are for highway construction work and road blocks to isolate streets during fires or accidents. Westinghouse Electric Corp., Pittsburgh 30, Pa.



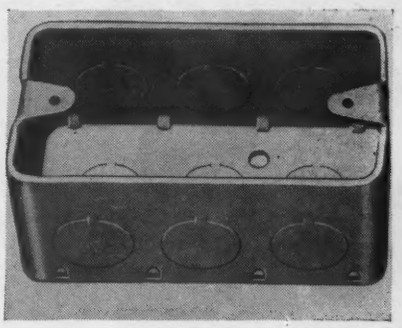
Starter

A new line of starters for use with 2300-4600 volt motors for protecting high voltage motor circuits against damage from short circuits has been announced. Known as Valimitor (volt-ampere-limitor) motor starters are designed for use at any point on any power system, regardless of the available kva. Starter and motor may be connected out on the end of the line or right onto the generator bus. They limit the maximum fault current that can be obtained on any system approximately 25,000 kva., which is interrupted by the Type ZHS magnetic contactor used. It is a self-contained unit. Upper half of the front cubicle contains the disconnect switches and Valimitors. Magnetic overload relays are mounted in lower half of cubicle. When starter is for use with synchronous motor, the automatic field switching panel for the synchronous motor field is also mounted in lower part of cubicle. 2300 volt top ratings are 600 hp. for 60 cycle systems and 300 hp. for 25 cycle systems. On 4150 and 4600 volt systems, top rating is 600 hp. for 60 cycle service and 250 hp. for 25 cycle operation. Electric Controller & Mfg. Co., 2700 East 79th Street, Cleveland 4, Ohio.



Transformer

A new luminous-tube hanger-type transformer has been announced. It is for indoor installation, and is approximately half the size and half the weight of conventional hanger-type units. A special mounting bracket makes it adaptable to wall or pendant mounting. It is available in six ratings, from 5000 volts, 18 ma., to 9000 volts, 18 ma., with either secondary cable leads or secondary electrode receptacles. General Electric Co., Schenectady 5, N. Y.



Utility Box

The new No. 2020 "Redege" flush device utility box can be installed with all types of wiring, including rigid heavy conduit, non-metallic sheathed cable, armored bushed cable and flexible steel conduit. Formed of pressed steel, it is said to provide more finger room through a square corner design of its full gauge steel walls. Rocking is eliminated by a smooth, flat back. Ears have been made integral parts of box. It measures $1\frac{7}{8}$ inches deep, 4 inches long and $2\frac{1}{8}$ inches wide. Eleven $\frac{1}{2}$ inch knockouts are provided—three on bottom, three on each side, and one on each box end. Lugs are tapped on $3\frac{5}{32}$ inch centers. Box carries Underwriters Laboratories approval. National Electric Products Corp., Chamber of Commerce Building, Pittsburgh 19, Pa.

fittings for

• thinwall conduit • rigid conduit • metallic and non-metallic cable • flexible steel conduit • service entrance cable • grounding devices • lighting fixture fittings

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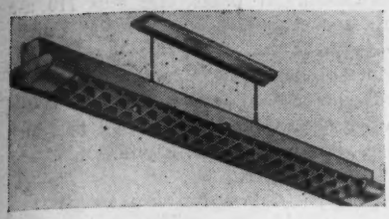


Lighting Fixture

The "Generaliner" fixture is designed for use with Colovolt cold cathode lamps for commercial and institutional lighting. Unit may be hung from stems or surface mounted on any flat ceiling, continuous line or individually. Louvres are available which can be swung open for relamping or removed instantly for cleaning. Unit uses four lamps. Lamps are 93 inches long and available in four standard colors, 3500° white, 4500° white, soft white and daylight. General Luminescent Corporation, 732 South Federal Street, Chicago 5, Ill.

Time Switch

New design changes in the "Badger" 50 ampere time switch have been announced. Switches feature a redesigned cabinet, which has six combination ¾ inch and 1 inch knockouts as compared to the previous four. Depth of cabinet has been reduced to bring the face plate of the mechanism flush with the edges of the case, making the dial more accessible for setting and switch terminals more accessible for wiring. Space for projecting dial and mechanism parts is provided in a one piece steel cover. Reliance Automatic Lighting Co., Racine, Wis.

Electric Clock

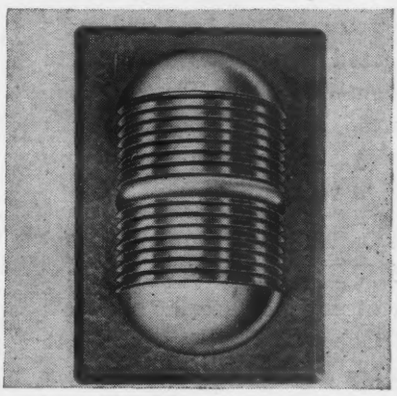
An electric clock suitable for use in hazardous locations has been announced. In general, the appearance of this clock is similar to the usual electric wall clock. It has a 13-inch dial, an outside diameter of 17 inches, a sweep second hand, and an external setting knob. The clock is constructed in accordance with the requirements of Underwriters' Laboratories for devices intended for use in locations where the atmosphere is hazardous because of the presence of flammable gases or vapors, or where the atmosphere is laden with highly combustible dusts such as exist in grain elevators. Crouse-Hinds Company, Syracuse, N. Y.

Junction Block

A new type of electrical junction block, called "Nu-Blok," which eliminates danger of short circuits due to faulty soldering or stray strands of wire has been announced. Designed for use in the wiring of portable refrigeration equipment, it can also be used in domestic refrigerators, freezers, refrigerated dispensers, water and beverage coolers and reach-in cabinets. Soldered or fastened with brass clamps, the splices are immobilized in the corner cells, by inserting the bared conductors in narrow slots which are smaller than the diameters of the splices. A laminated phenolic cover is press-fitted over the entire internal assembly, permanently isolating the splices an inch or more apart. The block is riveted. United Mfg. & Service Co., 783 N. Water St., Milwaukee, Wis.

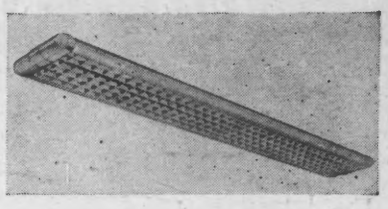
Fittings

A new line of EMT thin wall conduit fittings has been announced. The fittings are said to allow easier and faster installation as a result of the inherent machined taper fit provided by the inner surfaces, and the elimination of rings. Fittings bite well into the conduit surface when installed and insure a positive ground. They have been approved by Underwriter's Laboratories as raintight, and so designed as to be used over and over again after original installation. Fisher-Armour Mfg. Co., 757 Waveland Avenue, Chicago 13, Ill.



Pilot Light

These new utility colored pilot lights are designed for signal applications, warning, decoration, and general illumination. They are available in one type of 8-prism lens to four separate lens or more, mounted on a plate 4½ inches wide, the depth varying with the number of lens. Lens are available in five colors of unbreakable plastic and are lighted by No. 93S8 lamps for single contact bayonet base of 12 volts, 15 CP; or No. 6S6 candelabra lamps for screw base in 115 volt types. Units may be mounted in standard switch outlet boxes, with plaster rings. A variation of the pilot light, the DPF9 uses a 9 inch 6 watt fluorescent lamp for illumination purposes only. Cannon Electric Development Company, 3209 Humbolt Street, Los Angeles 31, Calif.



Lighting Fixtures

The streamlined designs of the "New Horizon" and "Officer" lighting fixtures feature plastic side panels and louvers. The tubular plastic for side panels is translucent and permits a maximum of diffused light directed horizontally. Plastic louvers provide shielding to prevent glare with a minimum of lighting interference. Louvers are destaticized. Slimline instant-start tubes are used in the "New Horizon" fixtures. The "Officer" model used four 40 watt instant-start tubes. Leader Electric Co., 3500 N. Kedzie Ave., Chicago 18, Ill.

Ballasts

A new line of instant starting ballasts, for use with long slim fluorescent lamps have been developed. These ballasts are furnished in a universal lead design for direct mounting on narrow wiring channels and fixtures with leads coming out of the bottom or used for other applications with leads extended from ends. Models are available for single 42T6 and 72T8 lamps, 100 m.a. and two 96T8 lamps, 100 and 200 m.a. Jefferson Electric Company, Bellwood, Ill.

Electric Heater

A built-in electric wall heater for use in bathrooms and where additional instantaneous heat is desired has been announced. Operating on the radiant-convection principle, the built-in heater is rated at 1320 watts, 115 volts a-c and d-c. It delivers 4507 Btu per hour. When unit is mounted in wall, removable steel guard projects ⅛th of an inch. Overall dimensions are 17 inches high, 13 wide and 4¾ deep. Exposed surfaces are finished in hammer-tone gray. Reflector is polished corrugated aluminum. There are two heating elements of nichrome wire. General Electric Company, Bridgeport, Conn.

Power Drive

A new power drive, called Porta-Power, for operating hand pipe cutters, threaders and reamers has been developed. It has a three jaw lathe-type scroll chuck in front and a self-centering workholder in rear which turns with the pipe. Additional features include a special chuck wrench ejector, a bump-proof start and

Turn to KNIGHT for
Smart Ways Out of Tough Spots

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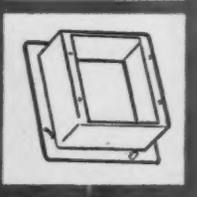

KNIGHT Case History No. 1043

Do you tie up money and labor in long, drawn out projects? Or do you cut work time and costs with KNIGHT Patented Electrical Products to solve "stickler problems?" Hansen Electric Company, contractors used Knight Electrical Outlet Boxes for top quality, durable, space saving equipment installed in record time.

4 Inch Square Wall Outlet Boxes were supported with the Knight RB 1, Adjustable Supports that permits installation at unusual heights on wall. The 3 Inch Knight Concrete Outlet Boxes,* also used, insure durability and make repair work easier because the cover is removable. Knight Patented Hung Ceiling Boxes, with 4 point suspension kept installation costs at a minimum, avoided costly pipe bending and insured firm ceiling support for permanent electrical units.

Three* Knight answers to why electrical contractors
turn to Knight for smart ways out of tough spots!

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stop switch, and permanent sealed-in lubrication. It plugs into any 110 a-c light socket; motor is reversible. Unit is 19¼ by 18 inches at the base and 12 inches high. It can be mounted on standard pipe legs to form a stand or bolted to a bench. Capacity is from ⅛ to 2 inch pipe. Ridge Tool Co., Elyria, Ohio.

Switch

A new heavy duty oil-tight foot switch has been announced. It is enclosed in a heavy cast case, gasketed for oil-tight applications. The wide pedal is operable from three directions but is protected against accidental contact or falling objects. Switch has adjustable stroke. Self-contained contact mechanism are easily wired and replaced. Snap action contacts, rated 600 volts pilot duty, a-c or d-c. Contact arrangements available are single pole, double throw, double pole, double throw; and two stage. Single pole switches have one, and two pole switches have two self-contained single pole, double throw units which can be removed and replaced using only a screw driver. Contact operation is snap action. Two interchangeable covers are available. Square D Company, 4041 North Richards Street, Milwaukee 12, Wis.

Tool

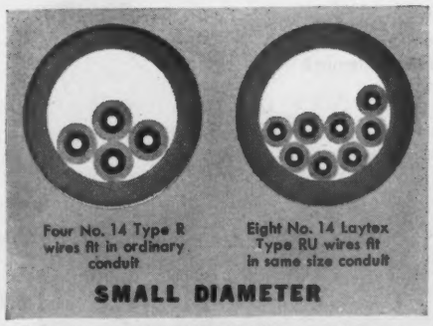
A new triple-purpose hand tool incorporating a cutter for popular sizes of machine screws and which also cuts and strips electrical wire has been announced. Known as the "Shearite" this pocket-size tool cuts off any of the four sizes of machine screws most used in electrical work. Screw to be cut is threaded into a tapped hole to desired length and handles closed. End of screw is sheared off, leaving screw free of burrs or damaged threads. It also serves as wire stripper, wire gauge and a guillotine type wire cutter. Aircraft-Marine Products, Inc., Harrisburg, Pa.

Cable

A new non-metallic sheathed cable developed especially for use on farms because it withstands weather extremes, fumes, corrosive vapors and most fungi has been announced. Known as Super PVX, it is also resistant to flames, moisture, oils, acids, alkalies, impact and abrasion. The conductors are encased in thermoplastic insulation which is wrapped first in paper, then in glass braid, and finally in ivory or brown thermoplastic sheath. Approved by Underwriters' Laboratories for installation wherever non-metallic cables are allowed. It is available with either two or three conductors in 14, 12 and 10 gage. General Electric Co., Bridgeport 2, Conn.

"It's easier to pull ...it's Laytex* RU"

Mr. USRUBBY, the Wire Engineer, knows what he's talking about. Electricians find that Laytex RU, with its special new wax finish, is surpassed by no other wire in ease of pulling and handling. To be exact, only 22 to 26 pounds pull was needed to pull Laytex RU through the test conduit shown at right—as compared with 32, 40, 42, 45 and 80 pounds, respectively, for 5 other leading brands. In other words, Laytex RU is 33% to 300% easier to pull!



Moreover, Laytex RU permits more wire per conduit on rewiring jobs because it is America's smallest diameter rubber covered branch circuit wire. United States Rubber Company's unique dip method applies 90% pure rubber to the conductors, eliminating the usual bulkiness and weight.

This special method also keeps the conductors perfectly centered in the insulation, preventing thin spots. But that isn't all. The physical and electrical properties of U. S. Laytex RU far exceed those of other building wires! In tensile strength, di-electric strength, insulation resistance, and elongation, LAYTEX RU is unsurpassed. The saturated cotton fibrous cover is flame-retardant and moisture-resistant. There is no finer building wire on the market.

U. S. Laytex RU carries the label of the Underwriters' Laboratories and is listed in the National Electrical Code as an all-purpose wire. Send today for a sample plus booklet containing more details about this wire. Write Wire and Cable Department, United States Rubber Company, 1230 Avenue of the Americas, New York 20, N. Y.

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RU wiring with **RU?**

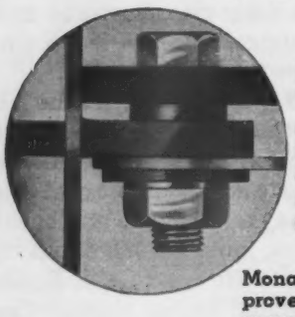
New POSITIVE LOCK Construction of Monarch Renewable Fuses

Assures → TRUE ALIGNMENT

The brass lugs inside the caps used on Monarch Fuses (see illustration at right above) fit into equally spaced slots in the brass casing inserts. This new and improved Monarch construction assures true alignment of the copper holding terminals . . . and establishes a positive lock on both ends of the fuse.

and for

STILL GREATER PROTECTION . . .



MONARCH'S Compressed Tension Lock Washer construction (illustrated at left) compensates for contraction and expansion of the fibre bar by exerting constant tension on the bar . . . and assures no loose parts. The washer also separates the fibre bar from the copper terminals . . . a spacer to provide better cooling.

Monarch Fuses are fully approved and are available through recognized wholesalers.

Specify Monarch Fuses *for improved* FUSErvice

MONARCH FUSE CO., LTD.
118 E. FIRST ST., JAMESTOWN, N. Y.

Flood and Spot Lamps

Two new 75 watt, hermetically sealed, internal reflector lamps have been developed. One, a reflector flood and the other, a reflector spot type, supplement the standard 150 and 300 watt R-40 bulb reflector flood and spot lamps. The mushroom shaped R-30 bulb lamp is the smallest floodlight and spotlight lamp with built-in reflector with voltage ratings of 115, 120 and 125. The dimensions are $5\frac{3}{16}$ inch maximum overall length by $3\frac{1}{4}$ inch nominal diameter. They are useful in lighting applications where limited space is available or where small, inconspicuous lighting units are desired, whether it be in the home, store, office or factory. Westinghouse Electric Corp., Pittsburgh 30, Pa.

Wiring Analyzer

This new analyzer checks new or old wiring systems under simulated load conditions. It is capable of identifying each outlet circuit number and polarity. It will instantly detect fire hazard hidden faults due to bad splices, corroded connections, wrong size wire, etc. It consists of two units. First, a powerizer source which attaches to the entrance panel to supply simulated load current. Second, a special rectifier meter with dial calibrated with four separate scales to show circuit identification, insulation resistance, ground resistance and a-c volts. A range selector knob is turned for the scale desired. Leco Engineering Company, Lincoln, Neb.

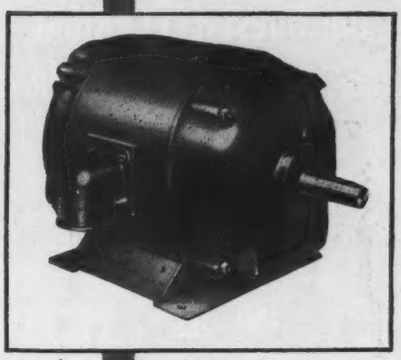
Vertical Drive Unit

The new vertical synchronous motor magnetic drive unit recently announced gives adjustable speed control for centrifugal pumps. Motor drives the ring of the magnetic drive at constant speed. Magnet member of magnetic drive mounted on gear shaft operates the pump at speeds required by liquid level control. Unit offers wire range speed control, precludes "hunting" and eliminates frequent motor starts and stops. A 250 hp. 1200 rpm. unit operates 200 rpm. vertical sewage pumps through a reduction gear. Electric Machinery Mfg. Company, 821 Second Ave. S. E., Minneapolis 13, Minn.

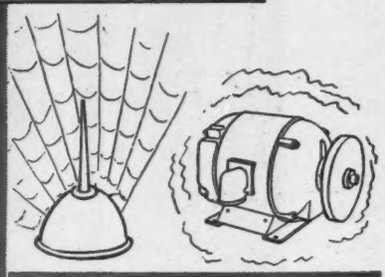
Time Switches

Three major improvements in this line of heavy duty time switches have been announced. They are now equipped with new fully-enclosed Hysteresis-synchronous, low speed motor. Design achieves higher torque both in starting and synchronous operation. New replaceable bearing system, lubricated with a special silicone product prevents it from being affected by temperature. Motor is housed in a molded shell to protect insulation of motor coil. Closer time limits between

WHAT DO YOU ASK OF A MOTOR ???



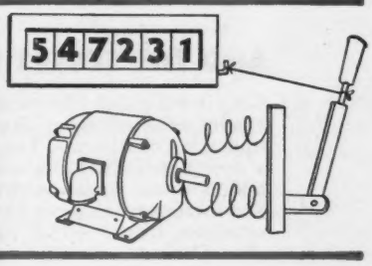
MECHANICAL RUGGEDNESS?
You'll find it in all Robbins & Myers motors. Before any new development goes into production, R & M laboratories make complete tests of motor stamina and lubricating methods. Wracking punishment proves motor ability to stand up under continuous pounding of unbalanced mechanical loads, excessive belt pull, and other destructive operating conditions.



AGE-RESISTANT, HIGH-VOLTAGE INSULATION?
In testing insulating materials and varnishes, motor windings are subjected to heat and repeated voltage surges in a highly corrosive salt-spray atmosphere. By such experiments, materials and methods have been developed that give Robbins & Myers motors utmost protection against time and usage.

SMOOTH, QUIET RUNNING?
Correct electrical design and careful mechanical balance assure a very low level of vibration and noise in all Robbins & Myers motors. And for certain applications requiring the absolute minimum, R & M hysteresis-type synchronous motors offer inherently silent operation.

FREQUENT STARTING?
It is nothing at all for the centrifugal switch in an R & M single-phase motor to last through a test of half a million cycles—the equivalent of 25 starts a day for 66 years of service. For fast starts or slow, high torque or low, R & M motors do the job right.



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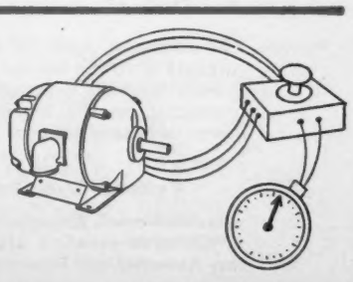
with ROBBINS & MYERS MOTORS
The above tests are typical of the capable engineering, combined with skilled workmanship and continuous production testing, that makes Robbins & Myers cool-running motors *so dependable* for all purposes. Wherever you see a motor with the R & M nameplate, you can be sure you're looking at high quality and lasting, *protected* performance. Made in fractional and integral horsepower ratings. Standard models in all types suit most needs; special motors built to specific requirements. Write *today* for free literature.



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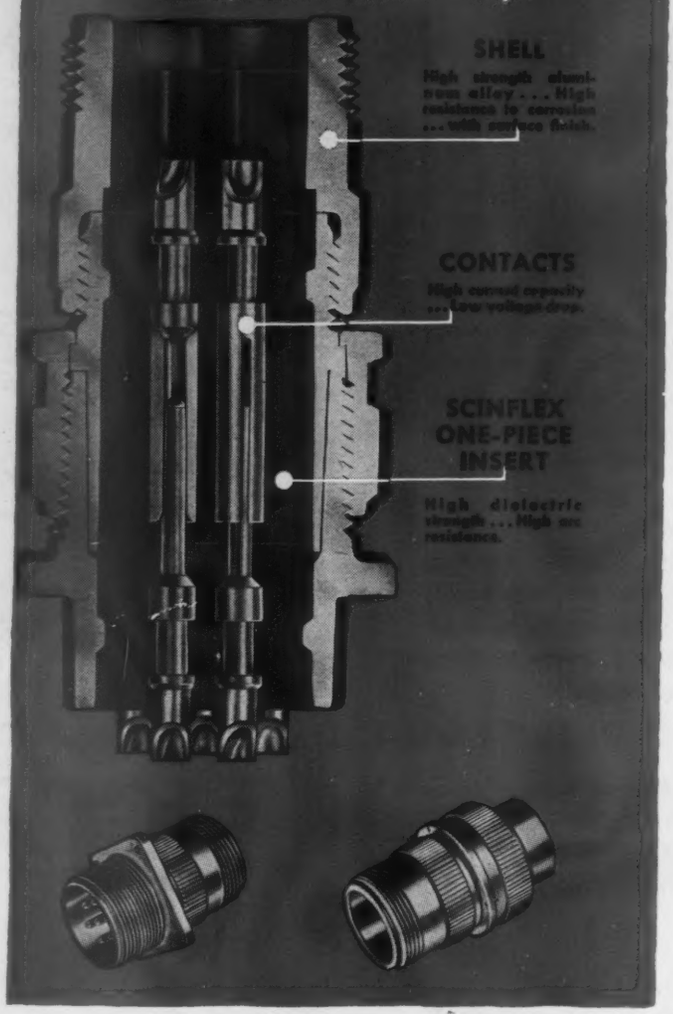

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Bendix-Scintilla* Electrical Connectors are precision-built to render peak efficiency day-in and day-out even under difficult operating conditions. The use of "Scinflex" dielectric material, a new Bendix-Scintilla development of outstanding stability, makes them vibration-proof, moisture-proof, pressure-tight, and increases flashover and creepage distances. In temperature extremes, from —67° F. to +300° F., performance is remarkable. Dielectric strength is never less than 300 volts per mil.

The contacts, made of the finest materials, carry maximum currents with the lowest voltage drop known to the industry. Bendix-Scintilla Connectors have fewer parts than any other connector on the market—an exclusive feature that means lower maintenance cost and better performance.

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Write our Sales Department for detailed information.

• Moisture-proof, Pressure-tight • Radio Quiet • Single-piece Inserts • Vibration-proof • Light Weight • High Arc Resistance • Easy Assembly and Disassembly • Less parts than any other Connector

Available in all Standard A.N. Contact Configurations

BENDIX SCINTILLA SCINTILLA MAGNETO DIVISION OF SIDNEY, N. Y. AVIATION CORPORATION

settings permit a wider range of applications. Manual tripping can be done at any time without disturbing the automatic operation. By including an omitting device, advance time cutoff, astronomic dial and two circuit type construction, the basic time switch units can be adapted to many applications. Sangamo Electric Co., Springfield, Ill.

Fluorescent Ballasts

A complete line of ballasts for all commonly used fluorescent lamps has been announced. Ballasts are available for all usual applications in the U.S.A. as well as for 50 cycle and special voltage sources used by foreign countries. Silicon steel is used and compensator windings are used wherever recommended by the lamp manufacturers to insure proper starting and long lamp life. Characteristics are matched exactly to the lamp for a maximum performance through rigid laboratory control of ballasts where all components are made by the same manufacturer. Westinghouse Electric Corp., Pittsburgh 30, Pa.

Plastic Laminate

A new Fiberglas-reinforced industrial plastic laminate designed for elevated-temperature electrical applications and known as Glastic has been announced. Characteristics of this new laminate are its combination of resistance to elevated temperatures and machinability, together with high impact and flexural strength values, resistance to delamination, arc-tracking resistance, and low moisture absorption. It resists tracking. It is suitable for use as slot sticks. Strip stock can be cut with ordinary shears, and edges of slot sticks can be chamfered with conventional chamfering or ordinary hand tools. Slot sticks can be driven into armature coil slots without spreading the ends of sticks, and without risking of snapping due to buckling. It is available in thicknesses from one-thirty-second of an inch to one inch, and in sizes from 12 to 18 to 36 by 42 inches. Laminated Plastics, Inc., Cleveland, Ohio.

New Equipment Briefs

An approved building **wire connector** for any indoor use has been announced by Jasper Blackburn Products Corp., St. Louis, Mo. Three sizes cover a wire range from No. 4 stranded down to No. 14. . . . An adjustable **bending** bar has been introduced by the Plomb Tool Company, Los Angeles, Calif. It handles many jobs that would otherwise require a sledge hammer, pry bar, vise or press.

Westinghouse Electric Corporation, Pittsburgh, Pa., announces a new line of thermal ampere-demand **meters** built

[Continued on page 185]

Motor Shops

Transformer Lead Indicator

Anyone who deals with transformers, whether he rewinds or installs them, has frequently felt the need for a simple, quick method of determining the correct order in which leads should be brought out of the case and identified for future connections. Tags are often missing or illegible and it is difficult to correctly retag the leads.

This chore is made easy through the use of test set designed and built by William C. Bedoit of the Chattanooga Armature Works, Chattanooga, Tennessee. The device rated third prize in the 1947 Award Contest of the National Industrial Service Association. Details herein were released for publication through the courtesy of the NISA Award Committee.

Called a "transformer lead indicator", the test set embodies simple construction and operation. With a little practice, perfect results can be obtained. Basic design consists of four 250-volt test lamps socket-mounted to the rear of a plywood base. Each lamp is connected to the center terminal of a double-throw knife switch mounted directly in front of it on the wood base. Blade clips of one side of the switch are connected to a common "rear" bus. Those on the other side are connected to a common "front" bus (see Fig. 1).

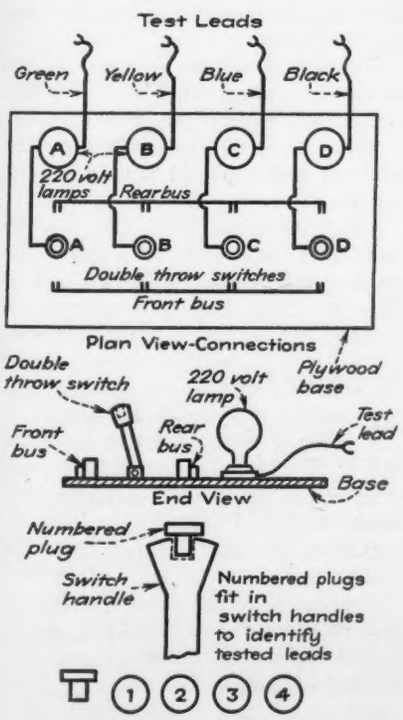

FIG. 1—Wiring diagram and sketch showing component parts of the transformer lead indicator.

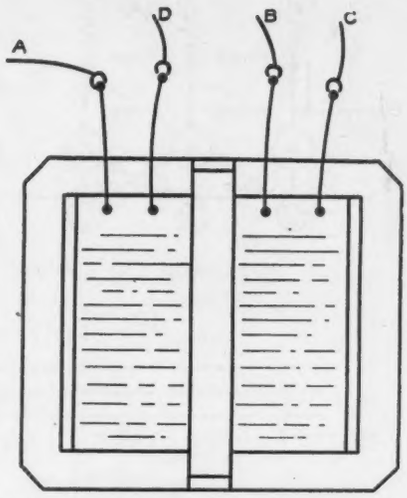

FIG. 2—Test leads connected at random to an unmarked transformer.

Switch travel is to the front in one position; to the rear in the other. The top of each switch handle is drilled to accommodate numbered identification plugs which can be inserted to mark transformer leads as they should be tagged after the test is completed. Lamps and switches are wired with No. 14 and No. 16 conductors. Test leads connected to each lamp are three to four feet of flexible cable equipped with rubber jacketed spring test clips.

To simplify testing, leads and wiring are color coded as follows: Lamp A-green; Lamp B-yellow; Lamp C-blue; Lamp D-black.

To illustrate its application, consider an unmarked transformer on which the leads are to be tagged for standard 110/220-volt connection. Clamp the test clips on the transformer leads at random as shown in Fig. 2. To find the correct lead numbers for this transformer, close switch A on the rear bus (Fig. 1) and insert identification plug "1" in the handle. Then close the remaining switches one at a time to make momentary contact with the rear bus. If no lamps light, open the switch and close the next one. Do this until two lamps light (Lamp A and that connected to the switch just closed). For example: Should Lamp A and Lamp B light when switch B is closed, insert plug No. 3 in switch B handle. Thus, if A is the beginning of transformer leg No. 1, B must be the end and hence is terminal No. 3 (Fig. 3a). Close switches D and C on the front bus and lamps D and C will light, showing D and C are terminals of the second leg.

Leaving switch A on the rear bus, close switch B on the front bus. Then, alternate switches C and D between front and rear until a position is reached where all lamps will light. Suppose this condition occurs when switch C is on the rear bus and D on the front bus. Then A and C are on the rear and G and D on the front, indicating a series connection. Switch A then has plug 1; B, plug 3; D, plug 2; and C, plug 4.

If we close switches with plugs 1 and 2 (A, D) on the rear bus and those with plugs 3 and 4 (B, C) on the front bus, no lamps will light indicating a parallel connection as shown in Fig. 4.

Now number the leads on the trans-

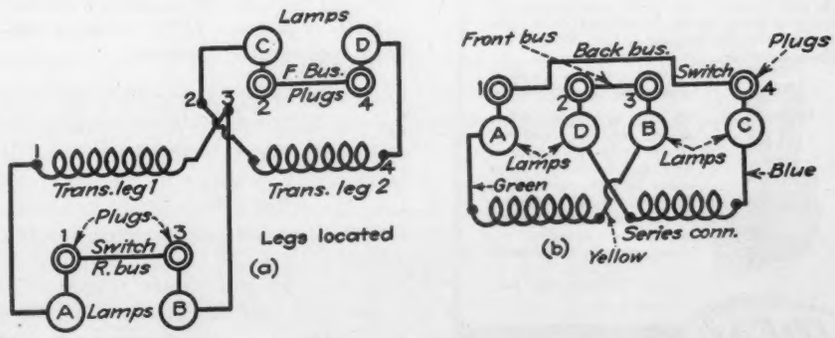

FIG. 3—Test lamp and switch positions and numbers (a) for locating leads of the two transformer secondary coils and (b) for determining series connection and correct markings. Use full or one-half voltage on primary. Never exceed 440 volts on test lamps connected to secondary.

Two-Way PROTECTION

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IDEAL VOLTAGE TESTER

You can't miss with *this* voltage tester! It has a solenoid voltage indicator *and* a neon test lamp. BOTH indicate relative voltage values—EITHER will function if the other fails. The Ideal Voltage Tester is *not* an ordinary "glo" type; it actually shows the nominal line voltage on an easy-to-read, calibrated scale. Numbers on scale are colored to correspond with fuse label color code. Tests AC circuits, 110 to 550 volts — DC circuits, 110 to 600 volts . . . blown fuses . . . grounds . . . frequency . . . DC polarity. Handy size, sturdily constructed; complete with leatherette carrying case.

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3 Tools in 1. Gives complete control of fish tape . . . keeps it reeled up . . . prevents springing and breaking . . . helps workmen avoid "live" parts. Makes it easy to pull tape through conduit. Gives a *big* grip. No slipping. Tape is easy to reel in or pay out. 5 sizes.

"SAFE-T-GRIP" FUSE PULLER

No slip! Formed to fit fingers; assures positive, full grip. Safe, handy, inexpensive. Eliminates danger, prevents bending of fuse clips. Three sizes; many uses.

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For solid or stranded wire. Always ready—no cocking. Triple Action . . . clamps wire, cuts insulation, strips —all in one operation. Eliminates wire waste. Made in two models. "Automatic" has lever to stop return of arms till stripped wire is removed.

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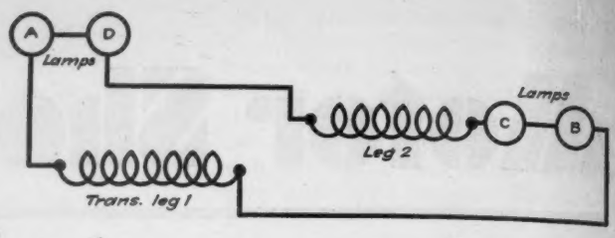

FIG. 4 — Lamp connections when transformer secondary coils are connected in parallel (for 110 volts). No lamps light under test.

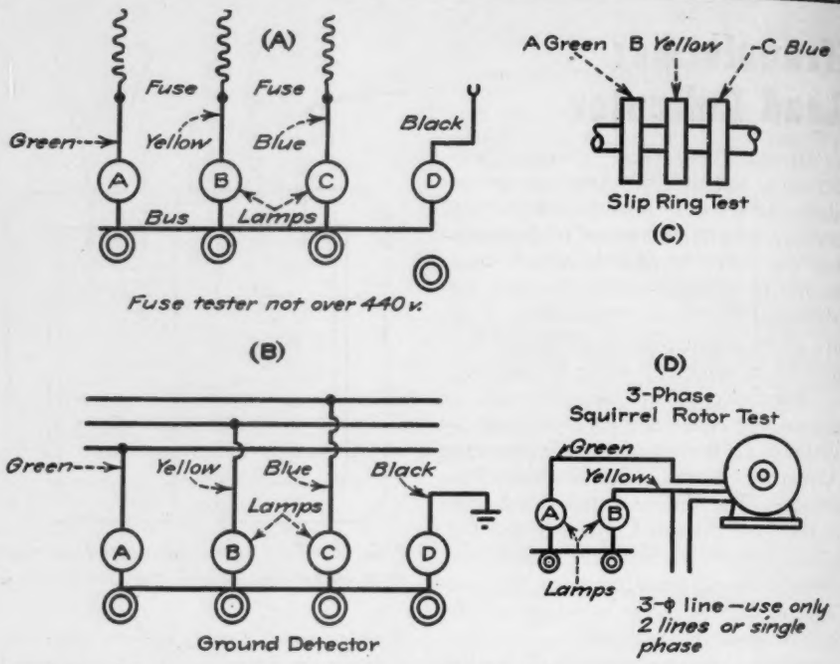

FIG. 5—Other connections for using the lead indicator as: (a) a fuse tester; (b) ground detector; (c) slip ring rotor test; (d) three-phase squirrel cage rotor test.

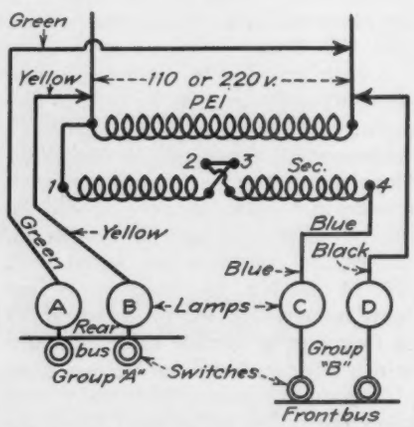

FIG. 6—Connections for a polarity test. Excite transformer with 110 or 220 volts. Compare brightness of lamps "A" and "B". If "B" is more brilliant, polarity is positive. If "A" is more brilliant, polarity is negative.

former according to the plug numbers on the switches to which leads are connected through the lamps. The transformer leads will be correctly tagged. After a little study and practice this test can be completed in a few seconds.

Numerous other tests that can be made with this device are illustrated in Figure 5. Connections for a fuse test are shown in Fig. 5a. Any three leads of the test device are clamped to the fuses. The three switches being used are all closed on the rear bus. An unlighted lamp will spot the defective fuse. The same test can be used to identify the neutral on a 110/220-volt single-phase, 3-wire circuit. The dark, or dim, lamp will spot the neutral conductor.

Connections for use as a ground detector are shown in Fig. 5B. The dark lamp identifies the grounded conductor. Lamp D (grounded) can be removed and replaced with a fuse if desired.

Slip ring rotor tests can also be made with this device. Remove the brushes and connect as shown in Fig. 5C. A dark lamp will indicate an opening in the rotor circuit. Voltages applied to the lamps should not exceed 440 volts. If necessary a reduced voltage should be applied to the stator.

A squirrel cage rotor test is shown in Fig. 5D. Apply a reduced voltage to the stator, using only one phase (two conductors). If the lamps blink or beat when the rotor is slowly turned, it is defective.

Personnel of the Chattanooga Armature Works have found that the required operational techniques are comparatively simple and the speed and accuracy of the results have established the equipment as having definite value in the modern motor repair and maintenance organization.

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	1436 EX	1366 EX	3179
Cold Flow	213/218° F	238/243° F	233/238° F
S.P. (R&B)	218/223° F	250/255° F	258/262° F
Pouring Temp.	315/360° F	350/400° F	400/450° F
Color	Brown	Tan	Gray
Adhesion	Good	Satisfactory	Satisfact
Penetration 77/100/5	0	0	
*Chloride Free	Yes	Yes	
Spec. Grav.	1.34	1 55	
Flash Point	390° F	450° F	

TEST METHODS

RING AND BALL SOFTENING POINT
MELTING POINT DRIP METHOD
COLD FLOW TEMPERATURE
POURING TEMPERATURES
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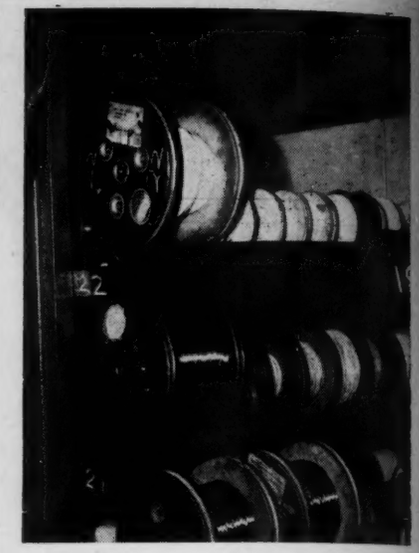

Reel racks are made from upturned channels while numbers on the end supports indicate gauge of wire on the various reels.

Channels Make Sturdy Reel Racks

Racks for supporting cable and wire reels are constructed with channels and angle irons in the storage area adjacent to the motor shop of the L and P Electric Company, Brooklyn, New York. Channels in a horizontal position with the lips of the channels pointing upwards keep reels from rolling. These channels are supported by angle irons at either end. The supporting angles are bolted to channel uprights. The vertical channels have two purposes; to support the reel racks and also to support a storage platform which is reached by means of a steep stairway. Numbers at the end of each channel shelf indicates the gauge of the wire contained at that location.

Among Indiana motor shop operators at recent NISA Convention in Pittsburgh were, (L to R) J. A. Meier, Meier Electric & Machine Co., Indianapolis; John W. H. Kayser, Wayne Electric Co., Ft. Wayne; F. L. Meier of the Meier Company and Walter H. J. Kayser of the Wayne Electric Company.

Industrial Electrification

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Inside the D-C Generator

How the direct current generator operates and how to select the proper machine for the load are discussed in the first of two articles.

By Warren W. Gregory
Westinghouse Electric Corporation, St. Louis, Missouri

A DIRECT current generator can be thought of as a mechanical city having three component parts: The *Magnetic Circuits,* which compare to our city boulevards along which flow the sustaining energy; the *Electrical Circuits,* which police the boulevards and keep the sustaining energy moving; and the necessary *Mechanical Parts,* or the city organization which combine all parts into an operating unit.

Every generator has several magnetic circuits winding through its iron structure. Each magnetic circuit carries its share of energy independent of the other magnetic circuits except where two magnetic circuits pass through a common structural member. We have *Magnetic Saturation* if the common iron structure is not large enough to carry the energy from both circuits at the same time. Magnetic circuits always close back on themselves and form closed loops like doughnuts.

The working magnetic circuits in a direct current generator may be classified as follows:

(1) The useful main pole magnetic circuits.

(2) The useful commutating pole magnetic circuits.

In addition to the useful magnetic circuits, the main pole and the commutating pole each have leakage magnetic circuits that perform no useful functions. However, since these "waste" circuits are negligible in well-designed machines, they will not be discussed.

Magnetism, like water, follows a path of least resistance. Technically, we call the resistance to the flow of magnetism *reluctance.* Now each different material has a different reluctance value. Fortunately, iron has a low reluctance value and air has a high reluctance value. Therefore, if we properly shape the iron parts of a direct current generator, crossing as few air gaps as possible, we can direct the flow of magnetic energy throughout the machine.

Figure 1 shows the main pole magnetic circuits of a four pole d-c generator. Notice how the iron parts of the generator are shaped so that the magnetic circuits (represented by the dashed lines) follow paths of minimum reluctance, and form closed loops.

Consider for the moment one magnetic section of the generator as indicated by A-O-B (all the other sections are duplicates). If we start at the frame, we find that the magnetic path leaves the frame and passes through an "N" pole, crosses the air gap to the armature teeth, passes through a section of armature core, across the air gap again, through an "S" pole and back to the frame where we started. Now a magnetic circuit alone is of no value, so we add an electrical circuit, or policeman, to our magnetic circuit to start and keep the magnetic energy flowing. We call this electrical circuit our *shunt field coils.* Excitation of the shunt field coils creates a magnetomotive force which in turn causes what is known as *flux* to flow around the magnetic circuits.

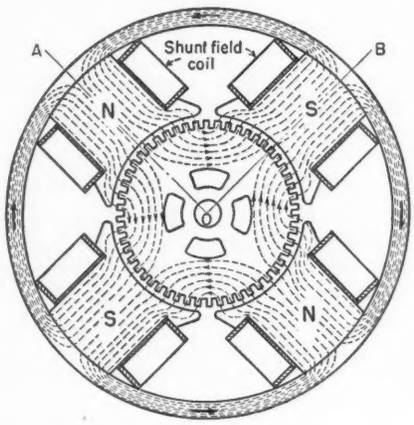

Fig. 1
Main Field Pole Magnetic Circuit

The flux which crosses the air gap from the poles to the armature and vice versa is known as the *useful main pole flux.* Note how the main pole face (The part of the pole next to the rotating armature) is shaped and spread out so that it covers about 65 percent of the armature periphery. This is done so that the main pole flux will not bunch up in concentrated spots but will tend to distribute itself evenly over the armature surface covered by the pole face.

You may wonder why distributing the flux is necessary. For the moment, let's imagine that flux is water and an armature conductor is a car traveling down a highway. Think how much easier it is for the car if you drove into a gentle rain rather than drive the car into a waterfall, even though the amount of water falling is the same in either case. So it is with an armature conductor entering into a magnetic field.

Consider now, the flux behavior in a generator field circuit. With the shunt field coils energized, let us think of the flux as flowing around and around the magnetic circuit somewhat like water being circulated by a pump in a looped pipe. The flux continues to circulate as long as the field coils are energized. When the field coils are deenergized, the flux stops flowing the same as water would stop circulating through a pipe if the pump was stopped. Unlike water in a pipe, the flux in a magnetic circuit disappears (except for a very small amount which continues to circulate due to residual magnetism) when the electrical circuit is opened.

The direction of flux flow can be

reversed by exciting the field coils in the opposite direction, the same as the flow of water in a pipe can be reversed by reversing the pump connections.

When the exciting field coils are connected so that the flux flows *from* the main pole toward the armature, that main pole is called a *north* pole. Using the same manner of reasoning, when the flux flows from the armature *to* the main field pole, that main pole is called a *south* pole.

Flux has one other peculiar property which we need our imagination to understand. Suppose we examine what would happen in the air gap under one (north) main pole if we rapidly moved a piece of copper wire (conductor) through the air gap at right angles to the flow of flux:

In Figure 2, we indicate the flow of flux from the "North" pole to the armature teeth by dashed lines ϕ_1, ϕ_2, ϕ_3, etc. Figure 2 represents a static condition, that is, the armature is not rotating. Notice that the flux ϕ_1, ϕ_2, ϕ_3, etc. follows a straight line across the air gap, the same as a rubber band would assume if fastened to the main pole and to an armature tooth.

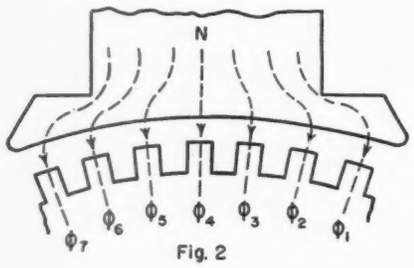

Fig. 2

Now notice what happens when a conductor "A" is moved rapidly through this air gap flux so that the conductor cuts directly across the flux flow at a right angle. Refer to Figure 3. Consider the flux stream as being rubber bands. Notice when conductor "A" comes in contact with flux stream ϕ_4,

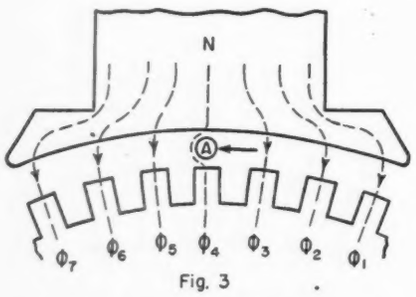

Fig. 3

that flux stream ϕ_4 bends around conductor "A" the same as a rubber band would tend to wrap around the same conductor. As conductor "A" moves farther from right to left, the flux stream will stretch just so far and then snap across the conductor "A" and reestablish itself in a straight line the same as ϕ_3, has already done. This rapid movement of a conductor across a flux stream at right angles is called "cutting lines of force". Each time a line of force is "cut" by a conductor, a small amount of voltage is generated in the conductor. Now if we connect enough conductors in series and move them rapidly enough through a strong enough flux stream, we can generate practical commercial voltages. It doesn't make any difference whether the conductor is moved through the air gap rapidly, as in Figure 3, or whether we place the conductor in an armature slot and rapidly rotate the armature, the result is the same, a generated voltage . . . so much for how voltage is generated.

Let us now consider what all this means to the average owner or operator of a d-c generator.

The voltage generated by a d-c generator is directly proportional to the total number of lines of force crossing the air gap between the main poles and the armature. Now, the total number of air gap lines of force is a function of the main pole excitation. Therefore, the generated voltage can be controlled by changing the shunt field excitation.

The maximum voltage that can be generated by increasing the shunt field excitation is limited by the magnetic saturation of the generator. The minimum voltage that can be generated is obtained from the flux of residual magnetism. Residual magnetism exists only when the shunt field excitation is zero.

From a practical standpoint, the maximum generated voltage is usually limited by the shunt field coil heating while the minimum voltage is usually limited by the stability of the voltage generated.

The voltage generated by a d-c generator is directly proportional to the speed the armature conductors are moved through the air gap flux. That is, when the main field excitation is held constant, and the armature rpm. is doubled, the generated voltage will be doubled. Conversely, if the armature rpm. is reduced to one-half, the generated voltage will be reduced to one-half.

The generated voltage of a d-c generator is directly proportional to the number of armature coil-turns connected in series. Changing the generated voltage by changing the armature coil-turns involves a new armature or rewinding the existing armature core with new armature coils having the correct number of turns to give the desired voltage.

Do not go out and arbitrarily change the driven speed of your armature, the field pole excitation, or change armatures, for there are other factors which must be taken into consideration.

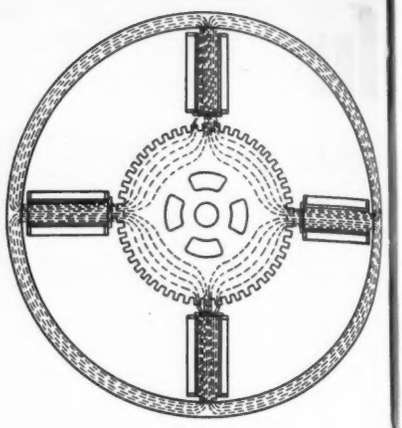
Fig. 4
Commutating Pole Magnetic Circuit

So far, only the main pole magnetic circuit has been discussed. Before we start on the commutating pole magnetic circuit, Fig. 4, which is separate from and similar to the main pole magnetic circuit, let us find out what happens in a d-c generator armature carrying load that makes the addition of commutating poles desirable.

Any good text book on d-c machines devotes at least one chapter to armature windings. They show how individual armature coils are connected in series and connected to the commutator. Now if we trace out an armature winding we will find the commutator bars, short circuited by the brushes, are connected directly to armature coils which lie midway between the main field poles. This is as it should be, for there exists midway between two main field poles, a neutral zone not influenced by the flux from either adjacent main pole.

Now, load the armature and see what happens. Refer to Figs. 5 & 6. Note that the load current flowing in the armature coils underneath the "North" poles is opposite in direction to that flowing under the "South" poles. When all the individual armature coils underneath a "North" pole are considered as one group and all the individual armature coils underneath a "South" pole are considered as another group, then we have in effect an electro-magnet on the armature periphery with poles, fixed in space, located midway between the generator main poles. These "Poles" are indicated by arrows marked "P" in Fig. 6. The axis of the poles "P" on the armature periphery coincides with the short circuited armature coils undergoing commutation beneath the brushes on the commutator. Flux emitted by the poles "P" is cut by the short circuited armature coils and a voltage is induced in these

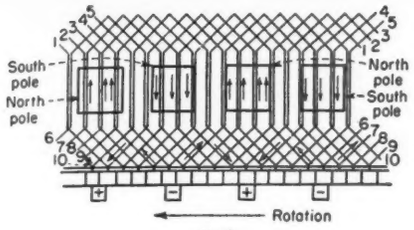

Fig. 5

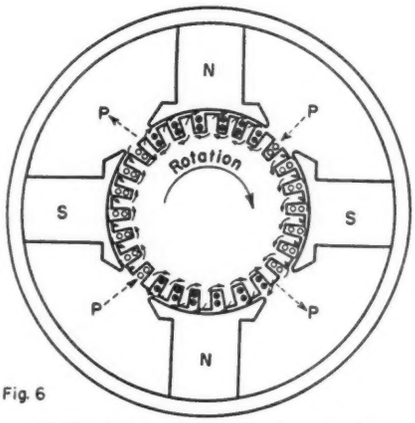

Fig. 6

● Indicates the current is flowing from the observer towards the paper.

⊙ Indicates the current is flowing from the paper towards the observer.

coils which is very harmful to good commutation. In older type machines, the detrimental effect of armature poles "P" was compensated by shifting the brushes (which shifts the coils undergoing commutation) under the influence of the proper main pole. This method, as we all know, had its limitations and is a compromise at its best.

In newer type d-c machines, commutating poles are installed midway between the main poles to counteract the effect of the armature poles "P". To correctly counteract this armature pole effect, the exciting coils on the commutating poles are energized by the armature current, therefore the compensating strength of the commutating pole is at all times (within the iron saturation limits) proportional to the armature pole "P" strength. If we make the commutating pole of opposite polarity to the armature pole "P", we can introduce a counteractive flux which will neutralize the detrimental effect of the armature pole "P" flux. In addition to the neutralization of the detrimental armature flux, we adjust the commutating pole strength so that it will furnish an additional corrective flux which, when properly proportioned, results in the fine commutation of modern d-c machines.

How To Select A D-C Generator.

D-c generators are identified as being either shunt wound, compound wound, or series wound. Mechanically, they are duplicates. Electrically, they differ only in the main field pole coils and the external operating characteristics. By external operating characteristics, we mean the way the voltage output changes as the load changes. Obviously, we should understand the operating characteristics of each type generator before selecting a generator for a new job.

The shunt wound generator has only one main field coil, called shunt field coil, for each main pole of the generator. Shunt field coils are wound with an insulated conductor on an insulating shell and vacuum impregnated to eliminate air pockets and prevent absorption of moisture.

The number of turns used in winding a shunt field coil may vary from a few hundred to several thousand. The size of the conductor used may vary from a very small wire to a relatively large wire. Both the number of turns used and the size of conductor depend on the excitation voltage, the available coil space, and the amount of excitation required by the magnetic circuit. The final coil design is usually a working compromise between all the variable factors by the design engineer.

Now, a self excited, shunt wound generator can be considered as the basic d-c generator. All other d-c generators can be considered as a modification of the basic shunt wound generator to obtain a different operating characteristic.

Curve (1), Fig. 7, is a typical regulation curve of a self-excited d-c generator. Notice that the output voltage of the generator decreases rather rapidly with an increase in load, especially after the full load point is reached.

This drooping external characteristic is desirable, although not necessary, where d-c generators are operated in parallel.

Self-excited shunt wound generators

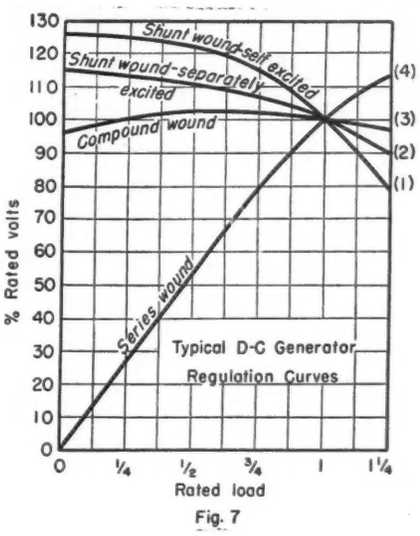

Fig. 7

are used extensively as exciters for individual synchronous motors and generators. They can be used for any other type application where the load remains essentially constant or where the change in output voltage is acceptable with load changes.

The separately excited, shunt wound generator is essentially the same as the self-excited shunt wound generator except, as the name implies, it obtains the power for its excitation from some external source. This naturally increases the cost of the installation and limits its use to applications where the additional cost is justified by the performance obtained.

Curve (2), Fig. 7, is a typical regulation curve of a separately excited shunt wound generator. Note that for the same full load voltage, the regulation, (change in voltage from full load to no load) is less than for Curve (1) of the same machine when operated self-excited.

In general, separately excited generators are used primarily for control purposes. For instance; assume that the generator is designed to operate at 575 volts. Now most control, for safety to operating personnel, is operated at 220 volts or 115 volts. Therefore, the generator is purchased for the desired operating voltage and to have its shunt fields excited from a source of a different voltage.

All variable voltage applications require a generator that is separately excited. This is necessary in order to obtain voltage stability at the lower voltages.

Typical variable voltage applications include high and medium speed passenger elevators, planer drives and many other variable speed machine tool drives.

A compound wound d-c generator is a shunt wound generator plus an additional field coil on each main pole called a series coil. The series coils are connected in series with the armature, so that the excitation furnished by the series coils is directly proportional to the load current carried by the generator.

In a compound wound generator, the shunt field coils are usually made smaller than in a straight shunt wound generator. This is done in order to provide the additional physical space needed for the series field coils. It is this reduction in the physical size of the shunt field coil that makes it necessary that the manufacturer be checked before using a compound wound generator as a straight shunt wound generator.

The series field coils are usually made from square wire, ribbon or strap, depending on the current to be carried

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by the coils. They are usually wound with enough turns to provide sufficient additional field excitation which, when added to that supplied by the shunt field coils, compensates for the terminal voltage drop from no load to full load.

If the series winding provides exactly enough additional excitation to make the generator have the same output voltage at full load as it has at no load, then the generator is said to be flat compound wound. If the full load voltage is greater than the no load voltage, then the generator is said to be over-compound wound. Conversely, if the full load voltage is less than the no load voltage, the generator is said to be under-compound wound.

Curve (3), Fig. 7, is a typical regulation curve of a standard compound wound generator. It is slightly over-compounded to compensate for a small line drop from the generator to the driven apparatus.

Compound wound generators are used to supply power for so called constant voltage applications. A typical illustration of this is a d-c auxiliary power bus in a power house. Compound wound generators are used extensively to supply d-c power in mines. In mines, the generators are almost all over-compounded so that the voltage at the driven apparatus is equal to, or greater than, the no load voltage of the generator.

The series field coils are made from square wire, ribbon or bare strap and are wound on an insulating shell in a manner similar to shunt field coils. The series coils have sufficient turns so that when excited with rated load current, rated load voltage is generated.

Series generators are used only for special applications where an increase in voltage is desired which is directly proportional to the load current. Series generators are used in circuits as voltage boosters and IR drop compensators where it is highly desirable to minimize the effect of circuit resistance and obtain speed control which is proportional to line voltage changes.

So far, only standard types of d-c generators have been described. Special d-c generators can be built having various combinations of separately excited shunt fields, self-excited shunt fields and series fields to give special operating characteristics to meet special load conditions. A d-c electric shovel generator is a good example of a special generator.

Electric shovel generators have a separately excited shunt field, a self-excited shunt field and a differentially connected series field, all in operation at the same time. This combination limits the maximum current output of the generator to a safe operating value when the driven motor is stalled.

From the above, it is obvious that the character of the load determines the kind of a d-c generator selected. Therefore, I suggest that before a new generator is purchased, that a thorough load study be made and the following load facts be established from which a suitable generator can be selected.

(1) Establish the d-c operating voltage of the load.

(2) Determine the total connected load in kilowatts.

(3) Estimate whether the calculated total load will remain fixed or whether provisions must be made for possible future load expansion.

(4) Estimate the load diversity factor, that is, what portion of the connected load will be in operation at the same time.

(5) Estimate the required maximum continuous kw. rating of the generator, taking into consideration short time peak overloads.

(6) Estimate the distance between the generator and the load center. Must line drop be taken into consideration or can line drop be neglected?

(7) Determine the character of the load. Is the load steady, or is it high fluctuating? Does the load require constant voltage or variable voltage? Is the load a general utility power load, or a special machine tool?

Once the above load information is known, it is relatively easy to select a d-c generator which will have an operating characteristic suitable for the load.

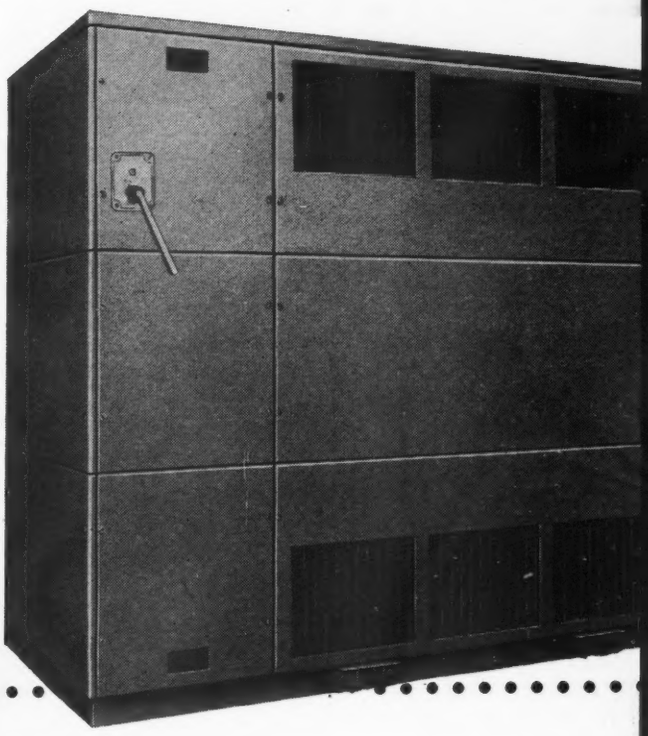
One other suggestion—most large electrical companies have capable engineers located in their district offices whose business is helping customers solve their electrical problems. Make use of their services.

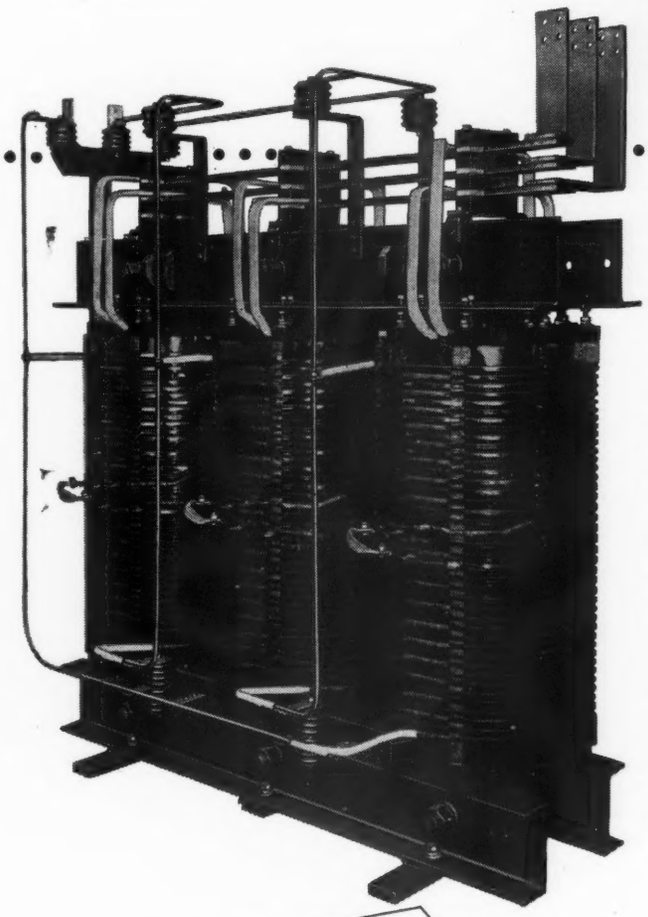
William A. Ensminger, Lenni Products, Inc., Lenni, Pa., demonstrates new paper slot insulation to Clarence Sumita (right), Buckeye Electric Co., Cleveland, Ohio. New insulation is marketed in 3300-inch rolls in widths from 1½-in. to 3½-in. Both edges have a rolled cuff eliminating need to reenforce with tape edging.

Wagner Dry-Type Indoor Transformer

Now available in ratings from 100 to 2000 kv

To meet industry's growing need for larger indoor dry-type load center transformers, Wagner has broadened its line of three-phase dry-type transformers to include ratings up to 2000-kva in the 15-kv class and below. Especially developed for plant power distribution circuits, these units are compactly housed in neat, attractive enclosures, which can be arranged to include primary and secondary switchgear compartments to form readily accessible, closely-coupled unit substations. Complete enclosure of all equipment protects against accidental contact with live parts. Relatively light in weight, so that they can be used in multi-story buildings, they are readily adaptable to any installation requirement.





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Transformers can be furnish with equipment for indicati winding temperature. Fans increasing the capacity 2 may also be provided when possibility of load grow warrants this addition.

Bulletin TU-56 describes detail the transformers, enclosures, the various ty of incoming line sections av able, and the optional equ ment and accessories that be furnished. Write for y copy today.

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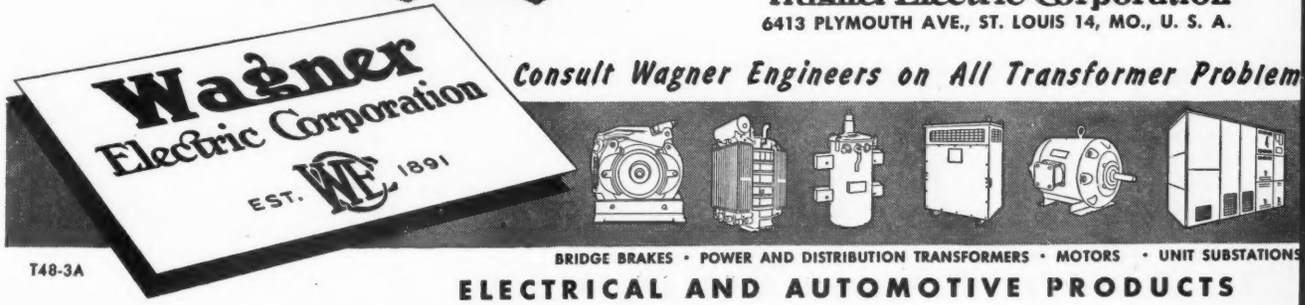

T48-3A

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Reader's Quiz

Coils for Solenoids

QUESTION 279—I notice that coils for solenoids on a-c circuits are wound of two different sizes of wire and connected in series. What is the reason for this? Also, does it make any difference as to which way the coil is mounted in relation to the plunger and why?—S.R.U.

A. TO QUESTION 279—Some coils are designed to do two jobs. That means ½ of the coil carries of an amp. and the other ½ of the coil carries 1/10th of an amp. as in Mercoid 110 volt solenoids. This results in two wire sizes. Minneapolis Honeywell has a solenoid which has ½ of the coil carrying current all the time, and the other ½ of the coil carrying current at the time when the coil is ready to shut the power, for 1 second. This results in a coil section which is suitable for a poorly ventilated section of a solenoid. Some circuit breaker firms use a shunt coil to hold the circuit closed against heavy springs, but the other ½ of the coil carries the load current, and bucks the shunt coil to get highspeed operation. This results in two wire sizes. Other firms have coils for two purposes, to save stock items.—H.S.

A. TO QUESTION 279—I have not found two sizes on any solenoid, and do not see any reason for such construction except inability to secure the size wanted. However, auto-transformer and spark coils such as the old Model T Ford coils use this construction because of the different current and voltage values existing in the second part of this question. The coil or its connections may be reversed without any disturbance to proper operation. The reason is that the core or plunger is soft iron. It has little or no residual magnetism. It is magnetized by the coil and pulls in regardless of the direction of the current.

However, any coil which operates a permanent magnet as a plunger or bar and which is operated by direct current depends upon the direction of coil flux for its operation and must not be reversed. Some relays such as burglar alarms and telegraph are in this class. Some telephone ringing devices have a permanent magnet as a part of the magnetic circuit but have alternating or pulsating current and these will work with coils reversed if the coils have correct relation to each other.—C.H.A.

A. TO QUESTION 279—This method is used to give fast response and great holding power. The part of the winding which consists of large wire and comparatively fewer turns gives fast response with a slight impulse. The part of the winding which consists of small wire and many turns gives slow response but great holding power. Therefore, the large wire portion should be at the start of the stroke and the small wire portion at the end of the stroke, in order to start the plunger with a slight impulse and hold it securely at the end of the stroke.—S.S.P.

Eliminating Shocks

QUESTION 280 — In a plant where the power circuit is ungrounded, shocks are obtained on the secondaries of welding transformers. These are apparently caused by the capacity to ground of the circuit. Is there a way to eliminate these shocks?—C.P.S.

A. TO QUESTION 280 — Grounding one lead of the transformer, where possible, will probably eliminate the shocks by preventing any voltage on the other lead that is above the output voltage of the transformer. If neither lead can be positively grounded, because of the nature of the work, then a ground can be made through a resistor. This will allow any excessive voltage to drain off and still not present a directly grounded lead. The resistor should be say 5 or 10 ohms and have a rather heavy current capacity. The resistor may be connected to either lead, but should be connected to the lead that will be more solidly grounded through the work during welding.—L.R.B.

A. TO QUESTION 280—If you are using a two winding transformer, it would make no difference whether or not the power circuit supplying the primary of the welding transformer was grounded. One side of the secondary is grounded to the work but the welding voltage is too low to cause a shock unless it was caused by an inductive kick and the welder was in contact with the hot electrode at the time the circuit was broken.

If you are using an auto-transformer, you ground one side of the power line when you connect one electrode to a grounded piece of work. Then upon touching a high tap, you might receive a shock. However, an electrode holder is insulated and a welder generally wears gloves and under these conditions, there is not much chance of receiving a shock.—S.S.P.

A. TO QUESTION 280—I take it the frames of the welders are grounded. If not, they certainly should be. If the secondary windings are grounded also at the end opposite to the "stinger", there will be no more shocks other than the normal secondary voltage. This in itself may be quite severe on open circuit and the "stinger" should be handled with the same care given any other live wire. —I.H.G.

A. TO QUESTION 280—In the place where I am employed to maintain equipment, I have had several cases of the same nature. Although our system is of the grounded neutral, four wire three phase system, your best bet is having all your equipment grounded to your water line at the service side of the meter and while you are doing this you might as well ground the steel of your building. This grounding will comply with the building code, thereby

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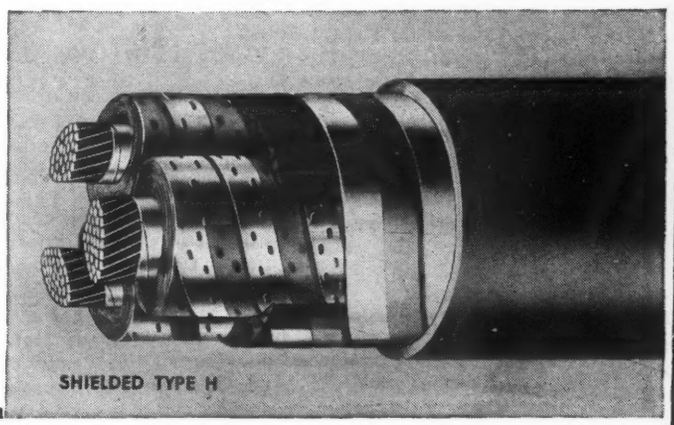

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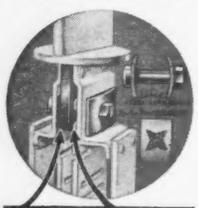

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eliminating the shocks, caused by capacity to ground of the welding transformer secondaries.—O.C.

A. TO QUESTION 280—I had similar trouble on a number of spot welders where the primary and secondary are not grounded. I grounded all metal parts not electrically connected to a water pipe. You'll find your shocking problem will be a thing of the past.—W.S.

Fuse Ends

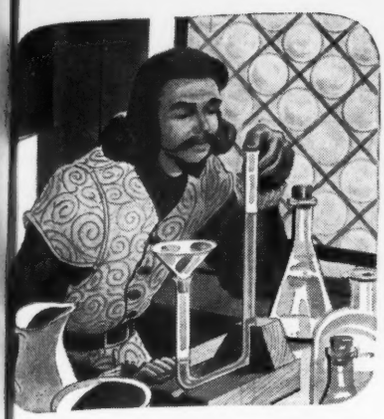
QUESTION 281—How can I recognize a poorly soldered 60 amp. fuse end? On several fuses the solder melted instead of the link. The fiber was not charred. —H.S.

A. TO QUESTION 281—If one make of fuse is bought, a poor connection can be spotted by comparison. This can be done by measuring the resistance of the fuses before they are installed or after they are installed, but with the line dead. This comparison could also be made with the fuses carrying load current by using the temperature or voltage drop as a standard. However, in this case, load differences would affect the test.—C.P.S.

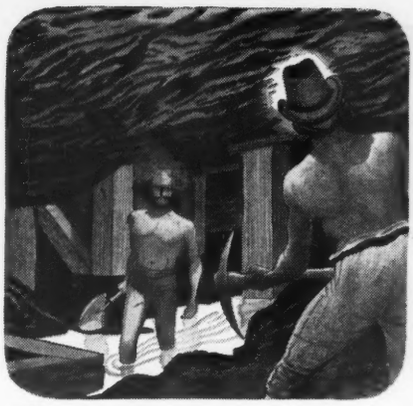
A. TO QUESTION 281—Sometimes a poorly soldered joint can be detected by close inspection. If the solder adheres or spreads itself on the other metals, the joint is good, while if it beads up, the joint is poor, due to unclean parts at time of soldering. The use of flux too strongly acid yields high resistance joints, but I don't know how to make it worth while. You might secure an ohmmeter sufficiently delicate to detect the high resistance of the poor joints. I would suggest a meter capable of reading accurately to one-tenth of an ohm or less.

Perhaps your trouble is not due to poor fuses. It may be caused by fuse clips being corroded, dirty or with weak tension. Possibly the terminal screws or nuts are loose. Maybe the pressure lug or solderlug does not properly clamp the wire. If the fault is in the fuses, and if more than a very few have this trouble, you should buy a better brand of fuse.—C.H.A.

A. TO QUESTION 281—It may not be possible to do more than inspect the fuse ends carefully. Perhaps fuses made by reputable manufac-



1 1643—Torricelli, Italian physicist, hastened the development of modern hydraulic pumps when he found water could be raised in a tube by air pressure.



2 1840—Steam pump engines were helping to keep water out of mines. But low-cost electricity which put the *big* push behind pumping was still to come.

3 1915—Howell "Red Band" Electric Motors were introduced. Soon, these rugged, industrial-type motors gained wide recognition in this and other industries.

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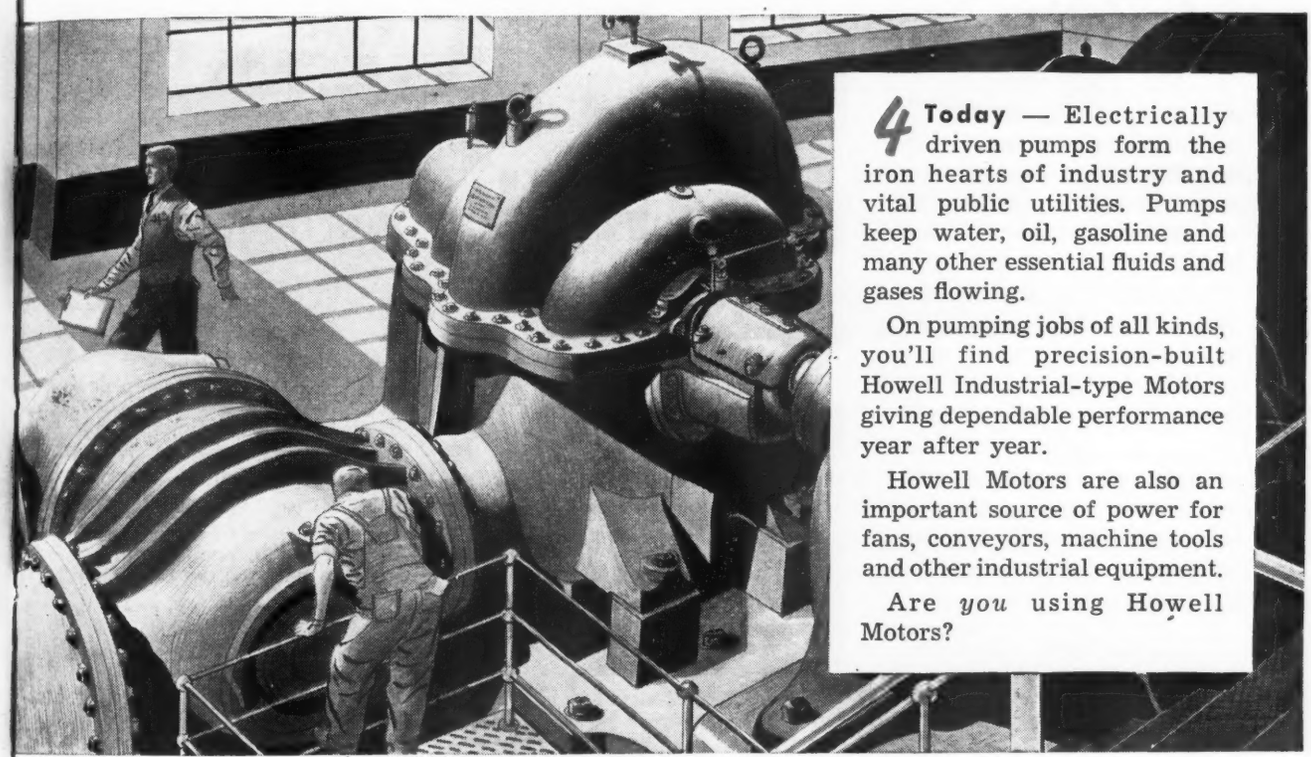

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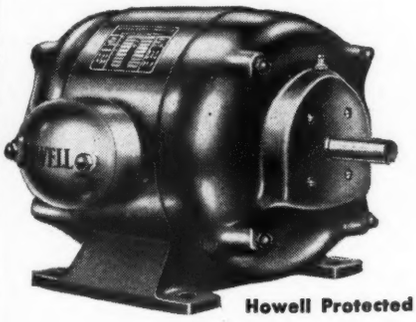

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turers will be more carefully co
structed.

A fuse operates because curre
through it raises the temperature
the element to the melting point. Norm
ally, the link temperature goes
where the cross section area is sm
est. If the contact resistance is hig
due to poor contact where fuse fits i
clip, the ends of fuses may become
hot that the solder will melt. The
is also the possibility that conducto
may not be well fastened to termin
and heat from this point may add
that developed at the clips. If cli
are corroded or loose, their spring te
sion conditions may become very ba
—J.E.W.

Spot Welders

*QUESTION 282—The pl
where I am employed has a nu
ber of spot welders. I would li
to know why the cables to
welding guns separate outwa
from each other noticeably wh
the guns are fired to weld. W
when these cables are taped t
gether, this isn't so noticeabl
The welders operate normally.
it a mechanical or electrical re
son that causes this?—L.C.D.*

A. TO QUESTION 282—T
phenomenon which L.C.D
notices on his alternating current spo
welder gun cables is due to a magneti
repulsion between the two cables. An
cable carrying current is surrounded b
a magnetic field and if two cables carry
ing current in opposite directions ar
placed side by side the magnetic field
repel each other. This is much th
same effect noticed when two magnet
are placed so that two like poles ar
opposite each other. The magnets wi
move apart.

As an illustration of the amount
force that might be expected: Assum
that a spot welder is pulling 2,00
amperes with two gun cables 120 inche
long and 2 inches apart. The force du
to alternating current is pulsating an
may be calculated as follows:

$$\text{Force in lbs.} = 4.5\ (\text{Amps})^2 \times \frac{\text{Length of cable}}{\text{Distance of cable}} \times 10^{-8}$$

$$= 4.5\ (2{,}000)^2 \times \frac{120}{2} \times 10^{-8}$$

$$= 5.4 \text{ lbs.}$$

—M.D.P.

A. TO QUESTION 282—Th
separation of the cables

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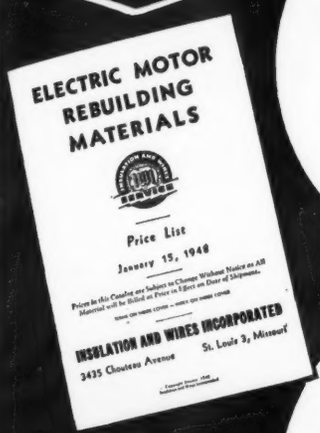

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WRITE FOR BULLETIN NO. 6

TRICO FUSE MFG. CO.

caused by magnetic forces. These in turn are caused by the electric current. The principles are the same as those involved in electric motors.

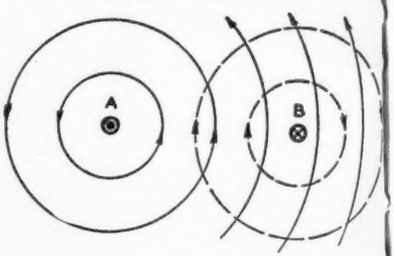
When two parallel cables are carrying current there is a magnetic force between them. Whether this force is attraction or repulsion depends upon the relative direction of the current in the two cables.

In most cases this effect is not noticeable as the currents involved are too small or the conductors are rigidly fixed in position. It is very noticeable in the cables to the electrodes of electric furnaces where the currents are large and flexible cables are used.—C.P.S.

A. TO QUESTION 282—A current-carrying conductor, when placed in a magnetic field, experiences a force which tends to make the conductor seek a position that will maximize the combined magnetic fields. Conductors carrying currents in the same direction will be attracted. They will be repelled when the current in each flows in opposite directions.

In the diagram, the current in Conductor A is assumed to be flowing toward the reader, while that in Conductor B is flowing away. Magnetic fields are set up in the directions indicated by the arrows, because a conductor grasped in the right hand, with the thumb pointing in the direction of current flow, will be surrounded by a magnetic field having the same direction in which the fingers are pointing.

To the right of Conductor B, it will



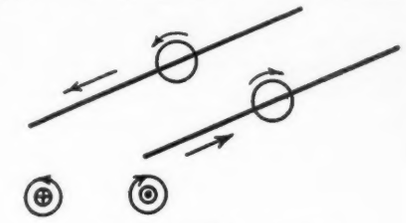
be noted that the lines of force from the two conductors are in opposition, reducing the net value of the magnetic field at this point. B will tend to move toward the right, seeking a position where the magnetic field directed upward between the conductors is equal to the sum of the fields directed downward to the left of A and the right of B. With Conductor B regarded as fixed in space, the same reasoning will show that Conductor A will tend to move toward the left.

If the direction of current flow in Conductor B is made the same as in A, the conductors will tend to move toward each other, because the net magnetic field between them is less than that encircling the two in combination.

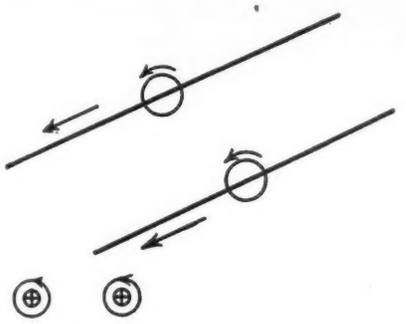
These forces between inter-acting magnetic fields are what cause motors to rotate, or knife switches to open

under heavy loads. Busbars must be braced against deflection, and coils braced to keep them from increasing their diameters and shortening their lengths. Theoretical formulas for the forces are given in physics textbooks, but due to the many factors involved, the problems are usually solved by empirical methods.—L.E.B.

A. TO QUESTION 282—The sketch below shows the condition existing when two wires carrying electrical current are located at a distance apart and when located close together. A magnetic field is set up around a wire carrying current, the direction of the lines of magnetic force being determined by the "right hand rule". Grasping the wire in the hand



Currents in opposite directions



Currents in same directions

Wires close — Wires separated

with the thumb of right hand pointing in the direction of the current flow, the fingers will encircle the wire in the direction of the lines of magnetic force. When the current flows in one wire in the opposite direction to that in the adjacent wire, the action of magnetic force is such that the wires repel each other. If the current flows in the same direction in each wire, the lines of magnetic force tend to make the wires pull closer together.

In the case of the spot welders mentioned in the question, the magnetic field surrounding the wires is extremely high due to the heavy rush of current when the arc is struck. The direction of current flow is opposite in the wires, hence the wires tend to separate when the arc is struck. Now when the wires are taped together, the magnetic fields

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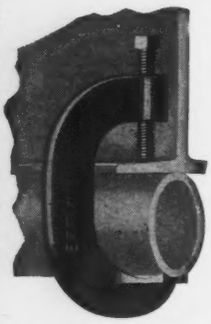

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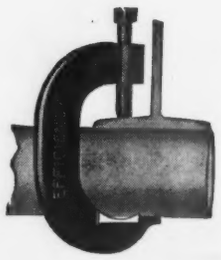

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of the two wires are so close to each other that they do not have the reaction to such a great extent. When separated their magnetic fields spread out and have more opportunity to react with each other.

In substation work conductors of large size carrying heavy currents must be so supported on their insulators that in case of a heavy short circuit on the circuit, the conductors will not be torn from their supports.—C.E.B.

Can you ANSWER these QUESTIONS?

QUESTION F13—In our plant we have a gutter enclosing busbars of about 1000 amp. capacity. Recently when I opened this gutter there were a good many burned places on it. Probably 50 or 60 altogether. These burns were of varied intensity probably the largest would be about like a 100 amp. short of short duration. These burns were on all three bars at varied distances from each other and from the other busbars. (3 phase 220 volt) There were only three or four very lightly burned places in the gutter and these were on the cover, at least four times farther away than the bars are from the back of the gutter. A static discharge is unlikely as these bars are only 6 feet long and feed a good many motors many of which are in poor condition. Due to the location of the plant, possibility of lightning is practically ruled out, and I am of the opinion that either of these would cause considerably more damage. Can a reader help me out as I am afraid more damage might result if it happens again?—C.M.

QUESTION G13—We have five magnet using cranes. The power for these magnets comes through a heavy duty cab tire cable which is retrieved on a reelite mounted on the trolley of the cranes. We have been experiencing considerable trouble due to cable breakages, mostly either just above or below the hoisting hook to which the cab tire cable is terminated before going to the magnet. We have tried installing a lock to prevent the hook from turning but while this helps, we still have cable breakages. I would like to know if any one has solved this problem.—T.J.H.

QUESTION H13—How can a 4 circuit or a 2 circuit motor winding be protected against burnout? Should one or more circuits open up?—H.S.

PLEASE SEND IN YOUR ANSWER BY JULY 15

Answered by
F. N. M. SQUIRES and GLENN ROWELL
Chief Inspector, New York Board of Fire Underwriters, New York, N. Y.
Electrical Engineer, Fire Underwriters Inspection Bureau, Minneapolis, Minn.

Questions on the Code

Gasoline Pump Motor

Q. *When wiring a motor-driven gasoline pump on a farm, how near may ordinary wiring be run to the pump location?—H.T.*

A. I presume you refer to the circuit required for operation of the pump. If the circuit is run underground with type U.S.E. conductors, they should be buried at least 18 inches when within 20 feet of the pump and must enter a rigid conduit extending down at least 18 inches below the base supporting the pump. If an overhead circuit is used, it must enter rigid conduit as required for a Class 1 Group D Division 2 location when within 20 feet horizontally or 5 feet vertically of the ground at the pump location. This will be found under Sections 5142-3.—G.R.

Dividing a 3 Wire Circuit

Q. *Below is a sketch of a 6 circuit cabinet on a 115/230 volt service. Shown in the sketch are two multi-wire circuits. May these circuits be used legally? In the sketch (A) is supposed to be two BX boxes ganged together and (B) a ceiling outlet from which the circuits split.*

In Article 3011, 1947 Code, we find that two different systems may occupy the same enclosure, and so we wonder if this sketch is also legal?—A.A.D.

A. Shown in the sketch are two 3 wire circuits divided into two 2 wire circuits, one divided at a two ganged switch box (A) and the other at a ceiling outlet (B). Both divisions are perfectly proper and do not violate the Code Rules.

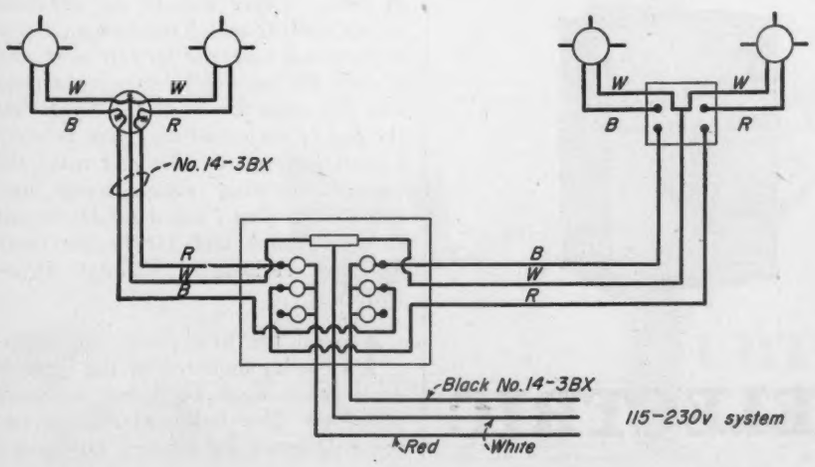
Section 3011 is not involved in the sketch as only one system is used; in this case a 115/230 volt system.—F.N.M.S.

Service Switch

Q. *What would be the procedure with respect to the service and disconnect means for a multiple-occupancy building, say an apartment building with a total of 10, 12, 16 or 20 apartments?—C.W.C.*

A. Where there would be more than six sets of service equipment, a main set to disconnect and protect the entire service to a building must be provided.

The usual procedure in a multiple-occupancy building is to have one service equipment (switch and fuses) control the entire service, and then have separate over-current protective devices for each apartment. Separate switches for each apartment are not always provided although that arrangement would be quite handy in case of trouble.—F.N.M.S.



Wiring A Dairy Barn

Q. *Early last fall we wired a large wooden dairy barn and inasmuch as the ground floor was completely sheathed with lumber, we fastened our Romex to the sheathing. The wall studs consisted of 2 by 6 inch timbers and the inside sheathing of ordinary 1-inch lumber. Now the inspector insists that we remove all cable fastened to this sheathing. Does the Code contain such a ruling?—H.W.M.*

A. No, the National Electrical Code does not as yet require an air space between a nonmetallic sheathing cable run and the inside surface of an outside wall in a building housing livestock, but it should for all installations subject to cold weather. In your area it is not uncommon to find as much as an inch of ice on the inside surface of such a wall. In some areas local rulings have been made requiring that running boards be used for all circuits which must be run along the inside surface of an outside wall and that they be furred out at least two inches. Other areas simply prohibit the fastening of this cable to the inside surface of an outside wall. You may find that your area has such a rule.

The past twelve years have definitely proven the need for such rulings, so even though the inspector who has insisted that you make this change may not be backed by the N. E. Code or perhaps even by a local ruling, it would seem most advisable to comply with the request. You owe your customer a reasonably safe job, and nonmetallic cable runs incased in ice in dairy barns cannot be considered safe.—G.R.

Here's how you get extra savings with mercury-vapor lighting using G-E Tulamp ballasting transformers:

These transformers do double-duty by combining the ballasts for *two* mercury-vapor lamps into a *single* compact unit! Their balanced design in itself provides high-power-factor operation. These features add up to important savings in cost four ways:

1. Lower Transformer Costs: A Tulamp transformer costs less than a pair of single-lamp transformers.

2. Lower Power Costs: Two ballast units in one transformer means more efficient operation.

3. Lower Wiring Costs: High-power-factor operation by Tulamp transformers saves copper. Starting current of Tulamp transformers is less than normal operating current, hence the size of wiring and fuses, as well as switch ratings can be based upon operating current values.

4. Lower Installation Costs: With Tulamp transformers, only half the number of transformers need be installed—and installation is further simplified by carrying a common ground through to each pair of lamps.

G-E Tulamp ballasts are designed for both the H-1 400-watt lamp and the H-5 250-watt lamp. Single lamp units are available for operation of all standard lamps. For information on General Electric's complete line of mercury lamp transformers, address the nearest G-E Apparatus Sales Office, or Apparatus Department, General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

412-83

Space Requirement

Q. *In Section 3737b if a switch had one tap to another motor used on same machine, would that be a violation of this Section? Switch box has ample room and no other conductors going through.*—W.J.S.

A. If there is adequate space for this purpose provided in the box, there would be no violation. The last part of 3737b covers this.—F.N.M.S.

Disconnecting Switch

Q. *We are installing the electrical equipment for a tile plant in which a 100 hp. motor will be used to drive a plug mill. Will the Code require us to use a motor rated switch for the disconnecting switch for this motor?—P.C.*

A. No, the N. E. Code under Section 4402-c states that for stationary motors rated at more than 50 hp. the disconnecting switch may be a motor rated switch or it may be rated in amperes or it may be a general use switch or even an isolating switch. A fine print note following recommends that whenever the disconnecting switch used for motors exceeding 50 hp. is not capable of interrupting stalled-rotor current the switch should be marked "Do not open under load".—G.R.

Auto Repair Shop

Q. *I am about to wire an auto repair shop which will specialize in repair of the electrical features of cars. There will be six separate repair stalls to which the owners desire to furnish 6 volts d-c for test work and 6 volts d-c for quick battery charging and 115 volts for tools and light. At the end of each stall they plan to erect a stationary work table and want the various electrical outlets wired into this bench. Can I run a single conduit to each bench and supply the three different receptacles through it?*—M.R.M.

A. In the first place, the receptacles mounted in the back of each bench must be 4 feet or more above the floor unless you use equipment designed for Class 1 Division 2

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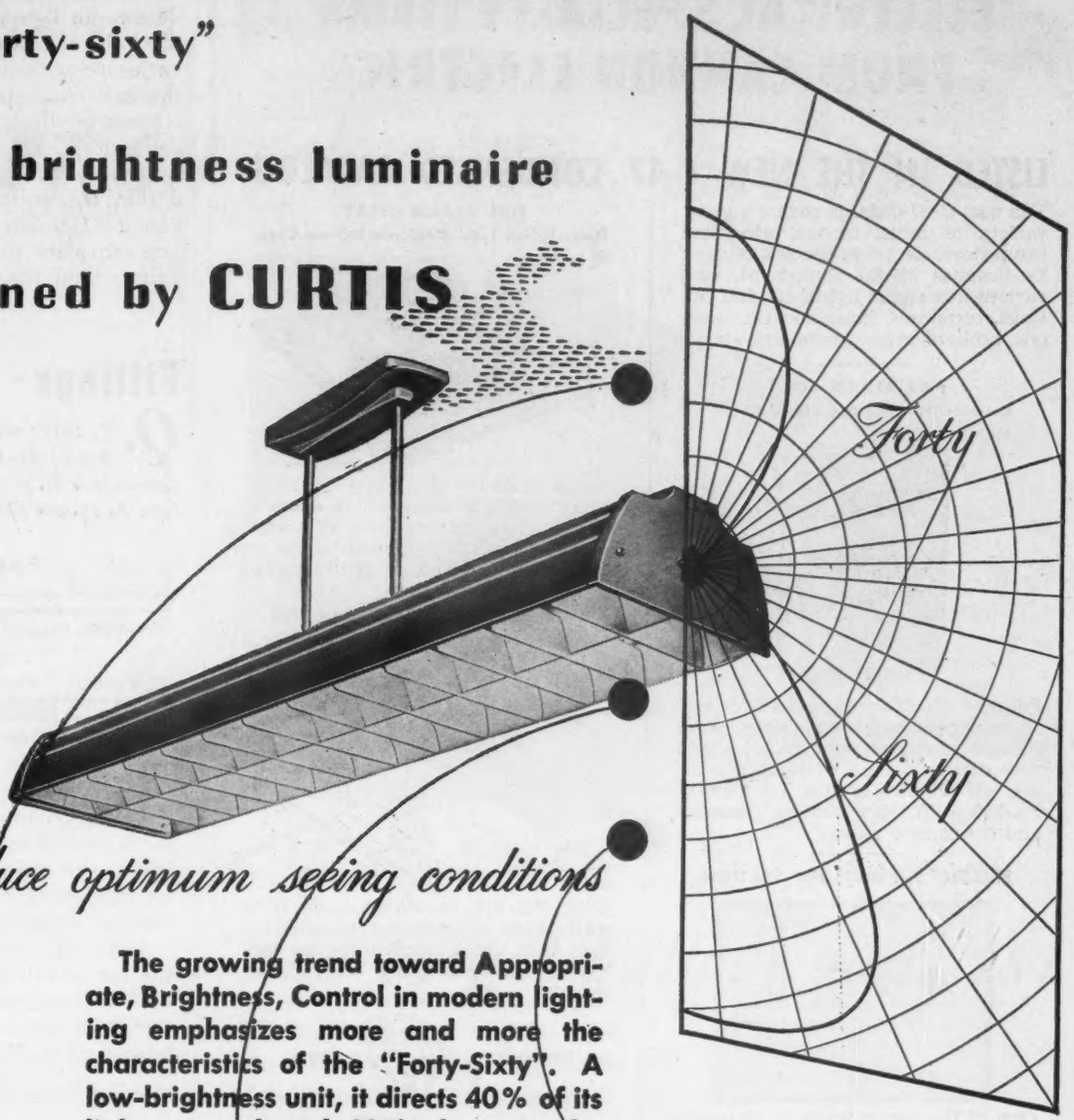
a low brightness luminaire

designed by CURTIS



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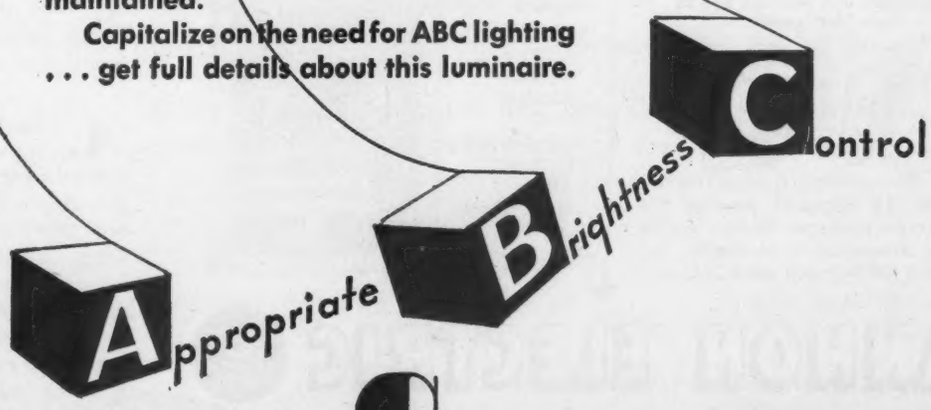

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LISTED IN THE NEW C-47 CONDENSED CATALOG

The new C-47 Catalog covers a great variety of multi-contact electrical connectors, electrical specialties such as hospital signal equipment, and various new signal lights, conduit fittings, terminals, lamp sockets, wagons, broilers, grills, sprinklers, etc.

FIRE ALARM BOX
Combination Open and Closed Circuit

For mounting on standard switch box or any 2 gang box, having single gang plaster cover, or surface mounted with extra sub-base. Contacts of wiping, self-aligning bronze. Ask for Nos. FA-105, -107. New catalog numbers and prices now apply.

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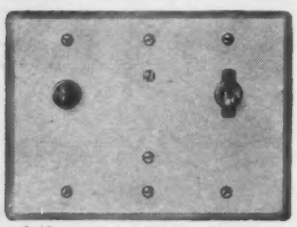
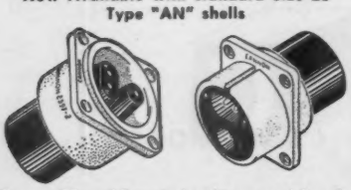


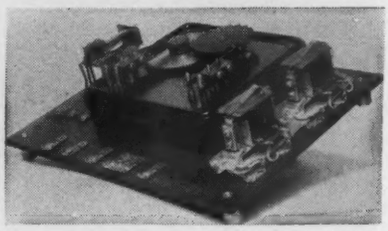
One of the many items in Cannon's complete Hospital Signal line, this SUP-1 is used in utility rooms, diet kitchens, etc., where call service must be provided (see page 25).

SPECIAL HIGH VOLTAGE CONNECTORS
Now Available with standard Size 28 Type "AN" shells



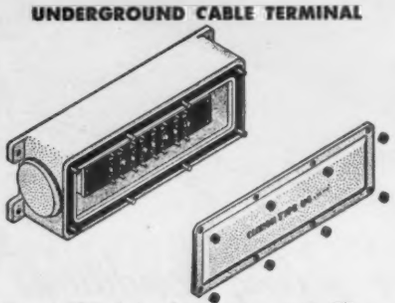
Three No. 12 contacts provide for high voltage circuits. Shown above are rack mounting type shells, No. 2397-1 and 2397-2 (see page 21).

FIRE ALARM RELAY
Motor Driven Type—California Uniform Code



See page 26 for this Type FA-102M Relay which is designed to operate from any station, sounding all alarm gongs intermittently, until glass in station is replaced or circuit restored.

UNDERGROUND CABLE TERMINAL



Type UG-8 is shown on page 27, a waterproof underground installation type with two compression-type gasket cable glands and 8 bridged terminals.

FIXTURE **STUD**

Among the conduit fittings on page 28, Type FS-2 is a fixture stud with locknut. Type FS-3 without locknut, ⅜" thread. Saves installation time. No bolts or mounting screws required.

For a copy of the new Cannon Electric C-47 Condensed Catalog, Address Dept. F-231.

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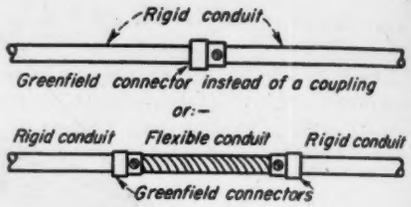
locations. Then if you will refer to Section 3011 you will note that conductors for light and power systems of 600 volts or less may occupy the same enclosure without regard to whether the individual circuits are alternating current or direct current provided all conductors are insulated for the maximum voltage of any conductor within the enclosure. Therefore, if you use 600 volt insulated conductors you can place the three different circuits within the same conduit.—G.R.

Fittings

Q. *Is there any rule prohibiting the use of flexible metal conduit and connectors in a rigid conduit installation as shown below?*—A.H.J.



A. There is no rule in the code prohibiting the use of flexible metal conduit in a run of rigid conduit. Where this is done, couplings approved for connecting flexible conduit to rigid conduit, should be used.

Inspectors in general, will require the use of fittings designed and listed by Underwriters' Laboratories for the particular use in which they are employed.—F.N.M.S.

Service Cable

Q. *May a Type SD service cable be used as the circuit wiring for an electric water heater when all conductors are insulated?—G.W.*

A. No. Type SD cables are designed only for use above ground as service drop cables from the pole to the building. These cables are not provided with a flame retardant outer jacket and need not have the inherent protection against mechanical abuse required for other types of service entrance cables. Therefore they cannot be run down the outside of the building and into the service equipment but must terminate at the service pot head. Under Section 3382 of the N. E. Code you will note that only Types SE or ASE cables may be used for domestic water heater circuits.—G.R.

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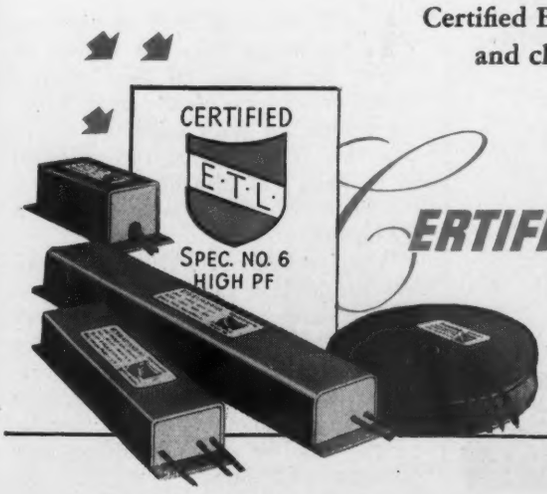

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Outlet Boxes

Q. *We are wiring a new plant in which wood waste is to be pulverized. We understand that the room containing the wood pulverizer is to be considered a Class 2 location and that fixtures, switches, etc. must be dust-tight. Can we use ordinary outlet boxes on the conduit runs in this room if we use bonding bushings?*—J.A.N.

A. This location would be considered as a Class 2 Group G Division 1 location unless the pulverizer and spouting were of such construction as to confine the dust within themselves. If dust is liberated within this room so that it would be considered a Division 1 location, the N. E. Code would require the use of threaded boxes and fittings. Inasmuch as the wood dust is not conductive, the boxes need not be of the dust-tight type provided such boxes contain only splices or junctions and do not contain any sparking or arcing devices nor any over-current protective devices—G.R.

Service Switch

Q. *A small commercial building is at present being serviced with 3 wire 220 volts, with No. 6 wire and a 60 amp. disconnect switch. Another small commercial building is under construction on the same property and will be under the same management. The owner desires only one meter, with the disconnect for the second building banked with the present disconnect. Will it be proper to service the second disconnect from the line side of the present disconnect or should a larger main disconnect be installed and then each building serviced from the load side with a 60 amp. disconnect for each building, using only one meter for the property?*—C.H.C.

A. If the total load of the two buildings does not exceed 60 amps., the present 60 amp. service switch could serve as the main building switch for both buildings. This, however, is not to be recommended as it limits (as also does the No. 6 service wire), the permissible load in the buildings.

What probably should be done (unless the load in each building is less than 30 amps. per side of the 3 wire line) is to provide heavier service wires. Then the present 60 amp. service switch could service the present building and another 60 amp. service switch could be provided for the new building.—F.N.M.S.

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. . . Workmen who used hand and power tools less than two hours to erect . . .

Glass and Plastic Ceiling

An interesting exhibit in New York City's Grand Central Terminal building is presenting the history, industry, culture and recreational facilities of the southern New England States in a series of displays which will be revised each month during 1948. What is of greater interest to lighting men at the show, however, is the presentation of an entirely new basic material designed for both interior and exterior building, and recommended for lighting, display and decorative purposes. This versatile material, used in the Terminal exhibit to form a luminous ceiling above the Show Window section, combines many attributes of particular value to lighting engineers, architects, builders and decorators.

To construct the exhibition ceiling, wooden joists were framed across the display area on 4-foot centers and panels of Prest-Glass were fastened to the bottom. Above the 28- by 40-foot ceiling, PAR-38 flood lamps on 2-foot centers were mounted along either side of the area and directed towards the center at a deflection of 15 degrees from the horizontal. With such a slight angle of light incidence upon the translucent panel surfaces, "hot" spots are eliminated, source brightness is minimized and general diffusion is achieved. And, since floodlights are positioned on either side of the ceiling with light beams parallel to framing joists, ceiling panels are evenly lighted on both sides of the corrugations and shadows are eliminated. Effect, rather than efficiency, was the major factor in positioning lamps but it is apparent that intensities readily can be increased by increasing the number of lamps and the angle of incidence.

Workmen who constructed the ceiling found that panels can be cut with tin shears, ordinary shears, power tools and pocket knives and that shaping and fitting was greatly simplified as a result. To hold panels in position, both staples and nails were found effective and it is stated that sheets also can be punched or cemented. Although made of glass, panels withstood rough handling and did not splinter, crack, split, bend or buckle during or after erection. Also commented upon was the ease in handling and erecting the panels for, although the men had had no previous experience with the material, the ceiling was erected in less than two hours.

Although Prest-Glass weighs less than seven pounds per 20-square-foot panel, it is extremely strong; weight for weight being stronger than aluminum. It also has unusual dimensional stability and is said to show no measurable change in size from minus-100 to plus-350 degrees F. Having an inorganic glass base makes the material fireproof and the manufacturer claims that it is impervious to both mildew and rot.

Representatives of the New Haven Railroad, sponsors for the Grand Central exhibit, state that another important advantage to using the fiberglass and plastic laminate is the reduced maintenance. Since panels are porous, much dust which normally would settle on the upper surface filters through to the floor. The small amount of residual dust is readily sucked through the panels by means of a vacuum hose.

Unusual variety is also obtainable in texture and color, for surfaces may be either dull or glossy, translucent or opaque, in 15 colors ranging from white to black and including red, yellow, blue, green, pink, magenta, coral, beige and sienna.

For luminous ceilings and for translucent curtains, walls, partitions and columns, Prest-Glass (8 East 12th Street, New York City) should prove to be a useful tool in the planning and designing of theatres, night clubs, restaurants, exhibition booths, showrooms, lobbies and window displays. Many other applications are possible. In price, panels compare favorably with other rigid translucent materials now on the market.

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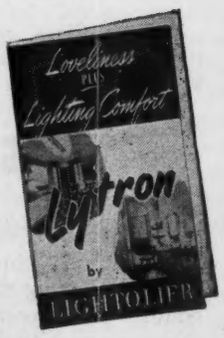

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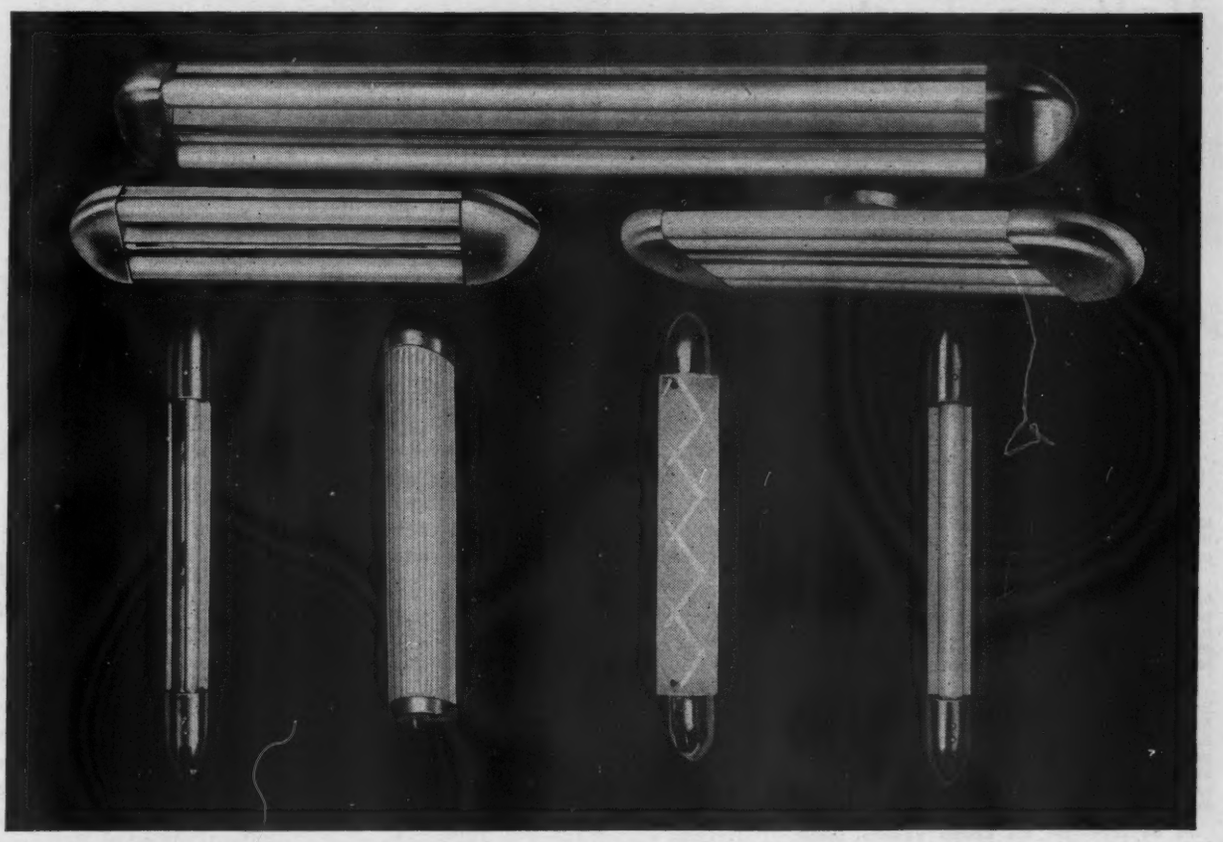

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It tells immediately and simply, without fuss or bother, if circuit is open or closed, magnitude of voltage between 110 and 600, whether a-c or d-c, pure or rectified, whether 25 or 60 cycles—for testing old or new circuits, fuses, locating grounds, open phases, etc.

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So be safe—get the Knopp Voltage Tester. It is preferred by engineers, electricians, utilities, contractors, and maintenance men the nation over. Here is the voltage tester you can rely upon, backed by the 21 years' experience of the Electrical Facilities Inc., technical electrical-equipment manufacturers of wide reputation. So don't kid yourself when testing. Play safe—know immediately if the circuit is open or closed and its true characteristics, by using the reliable Knopp Voltage Tester with its valuable safety features.

Order one from your dealer—see how it protects equipment, how it's easier to use in testing circuits, in locating faults—and you will KNOW that here is the quality BUY that costs less over its long years of safe use. Write for valuable, illustrated, free information sheets on the Knopp Voltage Tester.

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4232 Holden Street Oakland 8, Calif.

Continuous metal hood with inverted industrial fluorescent fixtures provides wide-area, low-brightness illumination for inspecting chrome-plated automotive parts such as grilles, hub caps, bumper guards and other items.

Fluorescent Hood Lights Conveyor Line

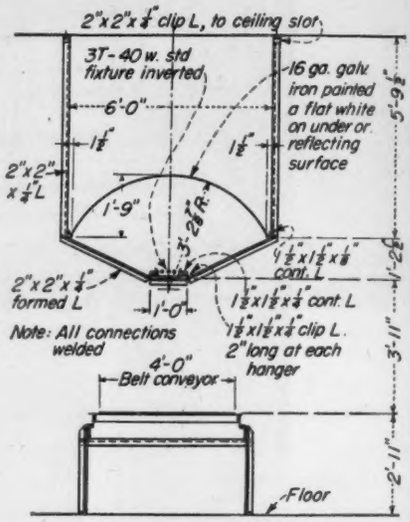
Specular reflection is one factor that must be carefully considered when designing illumination for inspection of highly polished surfaces. The light-source image of a direct lighting system would be reflected. Even with an indirect type of fixture, too high an intensity might be a disadvantage.

Engineers of the Cadillac Motor Car Division, General Motors Corporation, have studied this problem and designed a fluorescent lighting hood that gives, what they consider, the proper illumination for inspecting chrome plated parts in their assembly department.

The inspection line is 110 feet long and has a 4-foot wide conveyor belt traveling 35 inches above floor level. A continuous metal canopy 98 feet long and 6 feet wide was suspended above the conveyor. The reflecting hood is circular in shape, 21 inches deep, and made of 16 gage galvanized iron, painted a flat white on the underside.

Centered 35½ inches under the hood, on angle-iron supports (see Fig. 1), is a continuous row of 25 inverted industrial fluorescent fixtures, each containing three 40-watt, 3500° white tubes. Total lamp wattage (75 tubes) is 3000 watts. Units are plug-connected to conduit circuits paralleling the fixtures. Should a unit fail, it can be quickly replaced with a new one.

With the bottom of the hood 8-ft., ½-in. above the floor (5-ft., 1½-in. above conveyor), no reflected light strikes the eyes of inspectors who stand at their work. The 10 to 15 footcandles



Section through reflecting hood

FIG. 1—Construction details of indirect fluorescent light hood.

of wide-area, low-brightness illumination at conveyor belt level is sufficient to detect defects in the highly polished work surfaces. Were higher intensities used, reflected glare from the work might be encountered with resultant employee eye fatigue.

Jewelry Store Paces Lighting Progress

The Keller & George Jewelry Store has installed modern *Planned Lighting*. The installation, completed in September, 1947, is the fourth to be made in this store since it was first built.

Established in 1870, the first artificial lighting was by gas fixtures. These were replaced by two-piece prismatic

PITTSBURGH REFLECTOR COMPANY
Proudly Presents
ANOTHER IN ITS "PRESIDENTIAL" SERIES OF
DISTINCTIVE FLUORESCENT LUMINAIRES
"The Washington" B-7000 SERIES
96" SLIMLINE LUMINAIRE
FOR SURFACE OR PENDANT MOUNTING
INDIVIDUALLY OR IN CONTINUOUS ROW
Series B-7000 "Washington" Luminaires are available in 3 or 4 lamp models utilizing T-8, Slimline Fluorescent Lamps.

Once again Pittsburgh Reflector Company leads with distinctive and attractively styled 96" Slimline Luminaires which combine the advantages of maximum efficiency, simplified installation, easy maintenance and flexible application.

Illustrated above is "The Washington" with its curved Skytex Satinol glass side-panels and egg-crate louver bottom which extend the full length of the unit. The egg-crate louvers provide 45° crosswise and 30° lengthwise shielding and materially enhance its beauty. When ceiling mounted "The Washington" has the "built-in" appearance so desired in modern lighting.

You do your customers a real service when you recommend "The Washington" and other Pittsburgh Permaflector Presidential Luminaires. Every unit has the "saleable" features that mean more and quicker profit and lasting customer satisfaction.

A COMPANION INCANDESCENT ADJUSTABLE DOWNLIGHT

"The Dramatizer"

A-178-SERIES

The "Dramatizer" Downlight is used for in-line, end, corner and cross-over installations with the B-7000 "Washington" and the B-1000 "Lincoln" Slimline Luminaires. It is ideal for spotlighting merchandise, maps, walls, etc. since it can be rotated in a complete circle up to 35° angle and automatically held in any desired position.

For details on the entire line of Pittsburgh Permaflector Fluorescent Luminaires, Troffers and Companion Incandescent Equipment—write for Catalog 48-F.

"Something Better Has Come to Light"

"Pittsburgh" Permaflector

Pittsburgh Reflector Company

OLIVER BUILDING · PITTSBURGH 22, PENNSYLVANIA

MANUFACTURERS OF FLUORESCENT & INCANDESCENT LIGHTING EQUIP.

Permaflector Lighting Engineers in All Principal Cities

DISTRIBUTED BY BETTER ELECTRICAL WHOLESALERS EVERYWHERE

YOU ARE

SURE OF SAFETY

DEPENDABILITY

When you use

P&S Porcelain 2-Screw Sockets

Pass & Seymour pioneered in the manufacture of electrical porcelain way back when electricity was in its infancy. Over fifty years of "know-how" go into the manufacture of every socket — your assurance of the very best.

When the job calls for porcelain sockets, consult your P&S catalog.

Remember, P&S PORCELAIN SOCKETS are built to give years of trouble-free service.

PASS & SEYMOUR, INC.
SYRACUSE 9, N. Y.

In business for 78 years, Keller & George Jewelry Store at Charlottesville, Va., has paced lighting progress throughout its history. The new Planned Lighting system shown here, recently installed, constitutes the fourth complete relighting job.

glass bowl units suspended by three bronze chains from an ornamental cast bronze canopy, in the early days of carbon filament incandescent lamps. The third installation was made in 1937. It consisted of twelve 500 watt indirect metal bowl fixtures for general lighting and twelve 200 watt mirrored glass reflector units, equipped with concentric louvers, installed flush in the ceiling. These direct lighting units provide the sparkle needed which was lacking from the indirect lighting units. Footcandle intensity from this system averaged about 15 footcandles, which was five times as much as resulted from the previous three footcandle installation.

Introduction of fluorescent lamps has resulted in new standards of lighting—higher footcandles and better lighting techniques. This progressive jewelry store recognized this fact. It recognized that modern day selling requires good lighting, planned specifically for each lighting application. It therefore called in a lighting expert, electrical contractor Paul L. Carr of Godwin-Holstead Electric Company, and presented the lighting problem to him.

A lighting plan was made, based on today's modern lighting techniques for lighting jewelry stores. The store is 110 feet long, 18 feet wide, and has a 13-foot 6-inch high ceiling. The store display fixture layout consists of floor and wall display cases running down the length of the store on either side, with a center aisle.

To solve the lighting problem involved, two continuous rows of 4/40 watt Wiley Niagara Beam fluorescent units were installed on the ceiling, over the front edge of the floor cases. These units provide a high level of general diffuse illumination. Interposed in these continuous rows were adjustable beam 150 watt R-40 lamp Wiley Spots, No. CS-90, alternating with the four-foot long fluorescent units. With an increase in electric power from 8400 watts to 13640 watts, the new lighting system provides more than four times as much light as the previous all-incandescent system. The present intensity, after 60 days operation, averages 62 to 67 footcandles on the floor cases and in the center area throughout the entire store. By using 4500-degree white fluorescent lamps in combination with the R-40 incandescent lamps, it was possible to obtain a color temperature in the lighting result which many have said is the nearest approach to daylight yet possible with artificial light sources. Particularly effective are the soft, diffused highlights on the silver displays.

An interesting feature is the lighting in the wall cases. In each wall case are four wood shelves. The entire interior of the cases is covered with black felt, to provide maximum contrast for the bright metal displays. Many methods had been tried for lighting these cases, but none seemed satisfactory. The new lighting system solves this problem most effectively by tilting the R-lamps so that they flood the cases with accent lighting. Flood beam type lamps, equipped with concentric louvers, are located on five-foot centers in the line of lighting equipment overhead. These lamps then provide light for both wall cases and floor show cases.

The illumination inside the wall cases, with the meter placed about three inches from the front edge of each shelf averages 40-footcandles.

Office area is illuminated by Cadet 2-lamp 100-watt fluorescent luminous-indirect fixtures mounted end to end. Translucent side panels are softly lighted so that brightness of fixture and brightness of ceiling is approximately equal.

Uniform Intensities Light Office Areas

An irregularly shaped office, with a total floor area of 6388 square feet and a ceiling height of 11 feet 10 inches, has been relighted in the home office of the Public Service Electric and Gas Company, Newark, New Jersey. To provide shadowless illumination, 97 two-lamp 100-watt Cadet fluorescent fixtures, manufactured by the Edwin F. Guth Company, were arranged in intermittent rows of 2, 3 and 4 units each and were mounted at a height of 9 feet 4 inches above the floor level with a row-to-row spacing of 9 feet 3 inches. The fixtures are luminous-indirect, with 85 percent of the light reflected upwards and 15 percent downwards. The effective light distribution is 64 percent upwards and 11 percent downwards. Translucent side panels are softly illuminated and blend with the lighted ceiling areas above. Footcandle readings, made at desk level after 800 hours of service (5 months, 5 days a week, 7.5 hours a day) showed average intensities of 31 footcandles. At the time of the readings, employees were not at their desks, but desks and shelves were covered with papers and office equipment so that the readings are closely related to intensities as they exist during office hours. The lighting design was by Bruce J. Jensen, lighting consultant for Public Service.

The newly modernized Chicago Sales offices of Pittsburgh Reflector Company, in the Champlain Building, incorporates a modern showroom behind a visual all-glass front, facing on an elevator corridor.

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SELL

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"AF"

TIMERS

FOR

Automatic

CONTROL OF ATTIC AND WINDOW VENTILATION FANS

Sell comfort at a profit with Paragon "AF" Timers...designed for dependable, automatic control of attic or window ventilation fans. All-electric ...no springs to break. Accurate... powered with quiet Telechron motor. Easy to install...mounts to handy or single gang switch box, or may be surface mounted with conduit connection. Choice of two time ranges: 0 to 10 or 0 to 20 hours.

Sell comfort at a profit with Paragon "AF". See your jobber or write today for the complete sales story.

For fans up to 3/4 H. P. at 115 Volts AC.

$11.95 LIST

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TWO RIVERS
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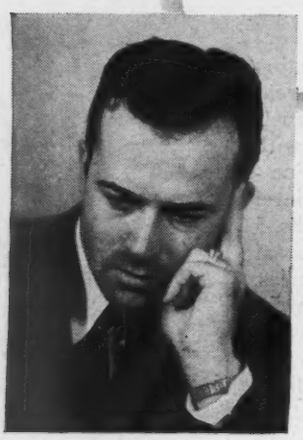
BUILDERS OF ELECTRICAL EQUIPMENT SINCE 1905



Worrying About Wiring?

You can end your worries over building wire. And that goes for industrial building wire, wire for homes, institutions, and any other type of building. Your worries end when you begin to investigate wiring insulated with VINYLITE Brand Plastic!

First, aging is no problem with such insulation. So time-defying is it that its age cannot be predicted beyond saying that it will last for many, many years in actual service! Many factories and office buildings being erected today, or re-wired, can look forward to almost indefinite life for their electrical insulation.

Phenomenally long life is just one advantage of VINYLITE Brand Plastic insulation. Small diameter is another. Wires and cables protected with such insulation occupy less space—accommodate themselves to congested circuits, awkward corners, complicated wiring diagrams and intricate assemblies. They come in many colors. They weigh less than other types.

If you are engaged in building, remodeling or rewiring residential or business buildings of any type, take full advantage of these remarkable properties! Be sure your technical assistants are thoroughly "up" on VINYLITE Brand Plastic insulation. Write Department DZ-41 and ask for a technical representative (available to industrial organizations) to call and discuss your wire and cable problems.

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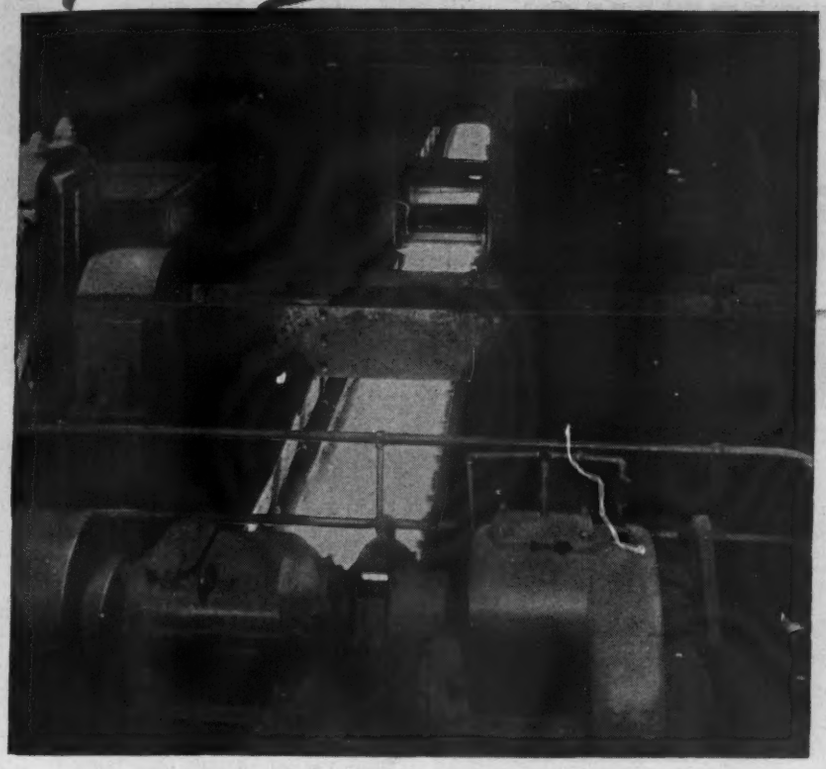
BAKELITE CORPORATION, *Unit of Union Carbide and Carbon Corporation* UCC 30 East 42nd Street, New York 17, N. Y.

WHEN the Heat's On



Specify DELTABESTON*

If your power wiring is subject to high ambient temperatures, corrosive vapors, and moisture; if a power cable failure would seriously affect your operation, it will pay you to investigate heat-beating Deltabeston power cables.

These heat-resistant cables have proved in numerous installations that they stand up under severe operating conditions. Insulated with felted asbestos and sheathed in asbestos braid or lead, these tough cables are available for service at 300 to 5000 volts, at temperatures up to 125 C (257 F). For temperatures up to 200 C (392 F), new silicone-treated Deltabeston cables do a tough day-after-day job. They are available in types for 300- and 600-volt service.

There's a Deltabeston power cable to meet any heat condition. Your General Electric merchandise distributor is always ready to give you help in matching the heat-beating Deltabeston characteristics to your specific requirement. Or, if your problem is unusual, he will put you in touch with a General Electric specialist on heat-beating wires and cables. For further information, write to Section Y13-618, General Electric Company, Bridgeport 2, Connecticut.

*TRADE-MARK REG. U.S. PAT. OFF.

GENERAL ELECTRIC

HI-AMBIENTS

application hints on the use of Deltabeston Wires and Cables

PUZZLE SOLVERS—Experienced General Electric field specialists are "on call" for assistance in solving your heat problems. Because these men can select from the complete Deltabeston line, you are sure of getting the exact cable you need for your specific application. Your General Electric merchandise distributor can put you in touch with a near-by G-E field man.

GRADUATES TO WIDE USAGE—Originally designed for infrared oven use, silicone-treated Deltabeston cables proved so successful that now they're recommended for many extra-high heat applications. They stay on the job at temperatures as high as 200C (392F), and are available for 300- and 600-volt service.

NEW WIRING GUIDE—THE DELTABESTON WIRES AND CORDS CATALOG is designed to help you select the right heat-beating wire or cord for your product. It presents, in easy-to-read form, descriptive data and construction specifications on heat-beating fixture wire, appliance lead wire, stove and range wire, hinge wire, heater cords, and flexible cords. For your free copy, write to Section Y13-618, General Electric Company, Bridgeport 2, Connecticut.

MAKES SELECTION EASY—To help you select the proper magnet wires for the jobs you've got to do, General Electric has prepared the *Deltabeston Magnet Wire Booklet.* This handy guide contains facts on the many kinds of magnet wire made by General Electric, and includes a handy specification chart to make selection easy. If you would like a copy, write to Section Y13-618, General Electric Company, Bridgeport 2, Connecticut.

A *New* REASON FOR SPECIFYING KAYLINE FIXTURES FOR

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PUBLIC BUILDINGS
HOTELS
THEATRES
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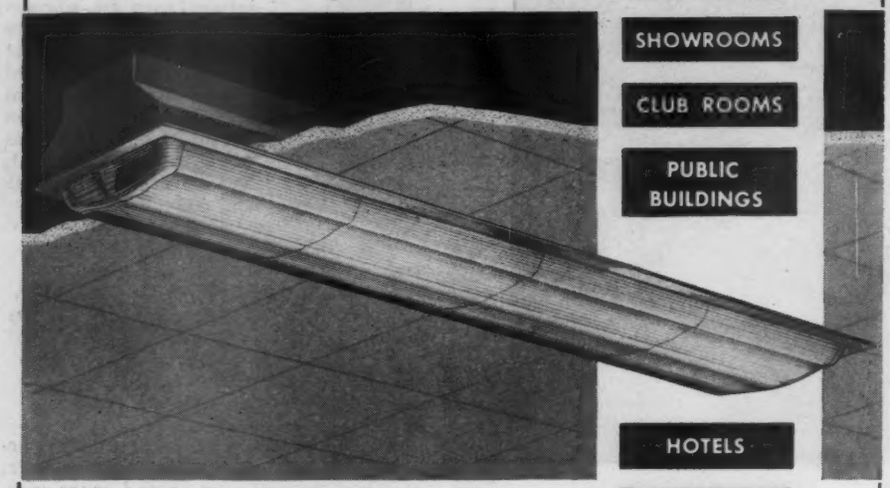

It's the NEW KAYLINE "CURVE-LENS" . . . newest member of a famous and complete line!

This new Troffer unit features a bent corning glass lens, removable with door in place. "Lenslite" units can be joined for continuous runs or used individually. The striking, practical design is characteristic of the truly complete selection of fixtures available from KAYLINE . . . including units for residential, commercial and industrial lighting.

Catalogs are available. Attach the coupon below to your letterhead, indicating your lighting application interest. No obligation.

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CHECK THE CATALOG YOU WANT

- ☐ KAYLINE Commercial Lighting Fixtures
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For over 55 years . . .

THE KAYLINE COMPANY
2480 East 22nd Street
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NEW LITERATURE

[FROM PAGE 134]

Flamenol, neoprene, rubber and other insulations. General Electric Co.

(37) ELECTRIC PLANT — Bulletin describes and illustrates one-cylinder air-cooled 700-watt electric plant. Universal Motor Co.

(38) FAN COOLED MOTOR—Folder has details concerning totally enclosed fan cooled 350 hp. 3600 rpm. motor. Burke Electric Co.

(39) RECTIFIERS—Illustrated 28-page booklet shows complete line of copper-oxide rectifiers and controls for electroplating, anodizing, electrocleaning and other similar processes. General Electric Co.

(40) LIGHT LIST—Numerical index of lighting fixtures with their prices. Day-Brite Lighting, Inc.

(41) PRODUCT CATALOG — Loose leaf catalog pictures and details wiring accessories, tools, outlet boxes and mounting devices. J. R. Richards Co.

(42) RECORDERS — Bulletin 247 discusses operation recorders, their selection and use, including general description, various drives and types of records, construction, circuits, uses and electrical characteristics. Esterline-Angus Co., Inc.

(43) GENERATORS — Folder includes new generating equipment developed during past year, ranging from 5 to 20 kw. Also included are materials handling, metal plating, battery charging, service equipment and tools. Motor Generator Corp.

(44) PULLEYS—Catalog 647 presents variable speed pulleys with adjustable motor bases, variable speed belts and special design features. Gerbing Mfg. Corp.

(45) PORTABLE REEL — Folder discusses portable reel, mounted on stand, containing 150 feet of insulated cord, plug in and lamp socket. Industrial Electrical Works.

(46) CUTTERS—File sheet has details and data concerning hand power cutters for bolts, rods, wire, cable, chain and flat stock. H. K. Porter, Inc.

(47) REELS AND TOOLS — File sheet discusses variety of wire reels, high speed boring tools, knock-out trimmer and store room reel. HyKon Mfg. Co.

Approved by UNDERWRITERS LABORATORIES

YES, the PENN-UNION Connector TAKES THEM ALL-

LARGER SURFACES for the WRENCHES ~ a good-sized HEX Top and Bottom

The men who use connectors appreciate the *better design* of the Penn-Union - - especially when they have to make a splice in close quarters, or any unhandy location.

Better Design is a feature of the entire Penn-Union line, which includes Tees and Taps, Straight Connectors, Terminals, Grounding Clamps, and many more fittings . . . every one thoroughly dependable, mechanically and electrically. *Preferred by leading users,* who have found that "Penn-Union" on a fitting is their best guarantee of unfailing service.

Far More in use than any other

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PENN-UNION ELECTRIC CORPORATION, Erie, Pa.

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The Complete Line of Conductor Fittings

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NO MYSTERY in selecting a "CERTIFIED RATING" FAN...

● When you're buying a propeller fan there'll be no question in your mind about its actual performance if you "look for the Certified Rating Label" on the fan you select.

In fact, any information you may wish to have can be obtained in advance from the Certified Rating standards adhered to by the Propeller Fan Manufacturers' Association, in accordance with the test code approved by the American Society of Heating and Ventilating Engineers.

For example, the Association's Attic Ventilating Code states in part: "The fan should have quiet operating characteristics, either belted or direct connected, mounted in a substantial frame and equipped with resilient mounted motor or other form of shock and sound-absorbing construction. When operating against a pressure up to .10" of water head the fan should deliver not less than 75% of its free air CFM rating."

You are therefore assured *in advance* that any Certified Rating propeller fan will have these desirable construction and operational characteristics . . . as well as all other qualities that are similarly certified.

Seventeen of the leading manufacturers of propeller fans are members of the Propeller Fan Manufacturers' Association, testing and rating their fans according to its Certified Rating code. This gives you ample opportunity to select a *certified* propeller fan on your next purchase.

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Air Deliveries are in accordance with Standard Test Code for Centrifugal and Axial Fans
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(48) RELAYS—Two-color folder presents sensitive multiple arm relays, including design features, stock assemblies and ordering information. Signal Engineering and Mfg. Co.

(49) PULLER—Folder shows photographs of Mighty Midget chain puller in use, and includes diagrams and descriptive text to illustrate many uses. Coffing Hoist Co.

(50) REFLECTORS—Bulletins 30-E, 30-D and 551 include data and sketches of industrial, inspection and strip-light fixtures. Day-Brite Lighting, Inc.

(51) VISIBLE RECORDS — Three-fold folder outlines various uses of visible records for expediting purchasing, scheduling, stocking and delivering of materials. Remington Rand.

(52) VOLTAGE REGULATOR — Transformer-type step feeder voltage regulator is described in 24-page illustrated bulletin with detailed operating and construction features explained. Allis-Chalmers.

(53) CONTROLS — Illustrated 66-page catalog lists all standard makes of instruments and controls with specifications and prices. Electro-Tech Equipment Co.

(54) KITCHEN WIRING—Wiring diagrams and kitchen layouts for residences are presented in 12-page booklet B-3979 with typical wiring specifications and dimensions for electrical units. Westinghouse Electric Corp.

(55) VENTILATION BLOWERS — Three bulletins; SDA 91-A, 92-A and 109; picture, discuss and give technical data for utility blowers, packaged blower units, deluxe, multiblade, belt and attic fans. Peerless Electric Co.

(56) FLOODLIGHT ASSEMBLIES—Various sealed beam floodlight assemblies with mounting accessories are discussed. Stone Mfg. Co.

(57) WIRING DEVICES—Catalog 48 is designed for quick and easy reference to broad line of wiring devices. Bryant Electric Co.

(58) MOTOR CONTROLS—New 16-page catalog includes photographs, technical information and utilization recommendations for electric motor controls. Furnas Electric Co.

(59) UNIT SUBSTATIONS — Economy, safety and adaptability of unit substations are discussed in 16-page bulletin describing construction details of 3 transformer types. Allis-Chalmers.

In the News

CHARLES L. SMITH

Succeeds Tousley on NFPA

Charles L. Smith, former chief electrical inspector for the City of Detroit is the new electrical field engineer for the National Fire Protection Association and secretary-treasurer of the International Association of Electrical Inspectors. He succeeds Victor H. Tousley whose retirement officially begins Sept. 1st. In the interim, Mr. Smith is located in the Chicago office of the IAEI and is gradually assuming the responsibilities of his new position.

Mr. Smith brings to his new job a wealth of background and experience in the electrical field. He started his career at the age of 12 as an electrical helper in Evansville, Indiana. After moving to Detroit in 1923, he worked as an electrical helper for various automotive plants and contractors. The following year he entered the employ of the City of Detroit and spent eight years as journeyman and foreman in the Department of Parks and Boulevards and Fire Department. Then followed two years as electrical construction supervisor for automotive plants and contractors. In the fall of 1942, he enlisted in the U. S. Naval Reserve as a First Class Electrician's Mate; served in the European theatre with the 97th and 108th Sea Bee Battalions during the invasion of Normandy; was promoted to Warrant Officer and attached to the Admiral's Staff under Admiral Harold R. Stark in London; was returned to the U. S. and placed on inactive duty in December 1945.

Mr. Smith re-entered the employ of the City of Detroit in May 1946 as field inspector for the Electrical Inspection Bureau; passed a Civil Service examination the following month and was appointed Assistant Chief Electrical Inspector. When Elmer Herndon resigned as Chief Inspector on Oct. 1, 1947 to enter the electrical contracting business, Mr. Smith, after passing the Civil Service examination, was appointed Chief Inspector.

During his Detroit career, Mr. Smith spent approximately nine years teaching electrical subjects in evening sessions of various technical schools. Among his organizational activities, he holds memberships in the Detroit Electrical Association (former member of the Board of Governors); International Association of Electrical Inspectors; IBEW Local 58, Michigan Inspectors Association; and the U. S. Naval Reserve.

New Code Committee

The organization meeting of the new Electrical Section of the National Fire Protection Association was held on May 11 in Washington in connection with the 52nd annual meeting of the Association.

Curtis W. Pierce, NFPA President, opened the meeting with an explanation of the purpose of the Board of Directors in creating the section, explaining that the objective is to secure a broader basis for the development of successive editions of the National Electrical Code and to provide a forum open to all those interested for the discussion of all fire and life hazard problems in connection with electrical installations. There is a high degree of inherent safety in electrical installations properly made in accordance with the National Electrical Code which is a recognized national standard used throughout the country as a basis for legal control of electric wiring and equipment and as a guide to good practice. The number of fires and accidents due to electrical installations is small in proportion to the almost universal use of electricity. However, improper installation practices and other misuses of electricity are still responsible for a large number of fires and misuse of electricity is reported in fire statistics as one of the leading fire causes. The purpose of the NFPA in organizing the new Electrical Section is to secure even more widespread cooperation of all interests concerned in devising means for reducing these losses.

Mr. Alvah Small, President of Underwriters' Laboratories, Chicago, Chairman of the former NFPA Electrical Committee, has been designated as Chairman of the section. Charles L. Smith, NFPA Electrical Field Engineer, is the Secretary. Members include representative electrical manufacturers, utility men, contractors, installers, inspectors, insurance men, and many others. At the meeting Chairman Small discussed the background of formation of the section and outlined plans for further development of the National Electrical Code.

Actual Code-making functions are to be performed by a series of committees of the section under the general direction of an Electrical Correlating Committee which consists of Mr. Small, Chairman, and George Andrae, Electrical Contractor of Milwaukee, E. A. Brand, Niagara Electric Corporation, Buffalo (alternate: O. K. Coleman, Consulting Engineer, Lafayette, Ind.), M. M. Brandon, Underwriters' Laboratories, New York, L. W. Going, Electrical Inspector, Portland, Ore., Richard L. Lloyd, National

Howard Davies (center), Davies Electric Motor Service, Philadelphia, learns about the new Fairbanks-Morse "pancake" motor at the recent Pittsburgh NISA convention from F-M representatives R. R. Anderson (left) and F. J. Long.

McGILL TRADE MARK *Levolier* TRADE MARK SWITCHES

ASSURE...

POSITIVE ACTION FROM ANY ANGLE

No. 41

No. 201

2 circuit
3 amp.
125 volt

No. 301

3 way pull
3 amp.
125 volt

No. 1020-S

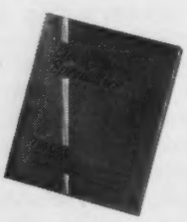
2 circuit
10 amp.
125 volt

No. 265

6 amp., 125 volt
Double pole
Double throw

The patented universal pull lever action of LEVOLIER Switches provides instantaneous control from any angle. Their high quality, watch-like construction guarantees dependability and longer service. Specially designed sizes and types are easily applied to motors, fans, electrical appliances and lighting fixtures.

Model Number 41, shown here, is the most compact 6 amp. switch on the market today — only ⅝" thick. Particularly adaptable for canopy mounting. Qualifying for a "T" Rating by Underwriters' Laboratories, through many years service, it will safely take an initial surge of 48 amps. — eight times its rated capacity.



A complete description of the many types and sizes of LEVOLIER Switches is found in McGILL Catalog No. 43. Send for your free copy today.

ONLY McGILL MAKES *Levolier* SWITCHES

McGILL MANUFACTURING CO., INC.
Electrical Division
450 N. Campbell Street — Valparaiso, Indiana

L. H. McClure, The Clark Controller Co., Cleveland, Ohio; Phil Stultz, Stultz Electric Works, Westbrook, Maine at the NISA Convention.

Bureau of Standards, James W. Lynett, New York Board of Fire Underwriters, August H. Schirmer, Bell Telephone Laboratories, George L. Swan, National Board of Fire Underwriters, Frank Thornton, Jr., Westinghouse Electric Corp., East Pittsburgh, E. E. Turkington, Associated Factory Mutual Fire Insurance Cos., Boston. Charles L. Smith, Electrical Field Engineer, will serve as Secretary ex-officio. The Electrical Correlating Committee will have executive and judicial functions. Its members have been selected on a personal basis rather than as representatives of organizations.

EEI Sees Market Expansion Ahead

Look for some aggressive "load-building" campaigns among future utility company activities. And with this, an opportunity for extensive wiring and installation work for the electrical contractor.

Utilities will be hard pressed to fully utilize the 15 million kilowatts of new generating equipment to be installed in the next few years (1940 total, 40 million kilowatts), unless profitable load is developed.

"The 'flood of natural growth' can no longer be relied upon to carry the nation's electric utilities to new records in use of electricity each year," Ralph P. Wagner, New York Power and Light Corporation, Albany, warned some 900 registrants at the Edison Electric Institute's recent 14th Annual Sales Conference at Chicago Edgewater Beach Hotel. He urged immediate training of aggressive sales staffs to meet this challenge.

TEMPOTOOL PAVES THE WAY...

for the exciting New TUCKER!

PATS. PEND.

The production line for the brilliant new TUCKER automobile winds for almost twenty-six miles through their huge Chicago plant. A chain-drag conveyor had to be installed for this entire distance—anchored to the concrete floor every four feet. Faced with this stupendous task, TUCKER turned to the TEMPOTOOL method of fastening.

Using the "Model 38" and a two-man crew, they anchored ¼-inch steel cross plates directly to the concrete flooring with standard drive pins.

The company estimates that they saved *75 per cent* in time over conventional methods—and did the job for *half* the usual cost.

This is only one of many dramatic examples where TEMPOTOOL is saving time and money for users *every day*. For fast fastening—investigate TEMPOTOOL!

INVESTIGATE! SEND FOR THE NEW TEMPOTOOL BROCHURE *NOW!*

Tempotool Model "22" with Safety Shield

Tempotool Model "38" with Safety Shield

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Dept. 301 • 1900 Euclid Avenue • Cleveland 15, Ohio

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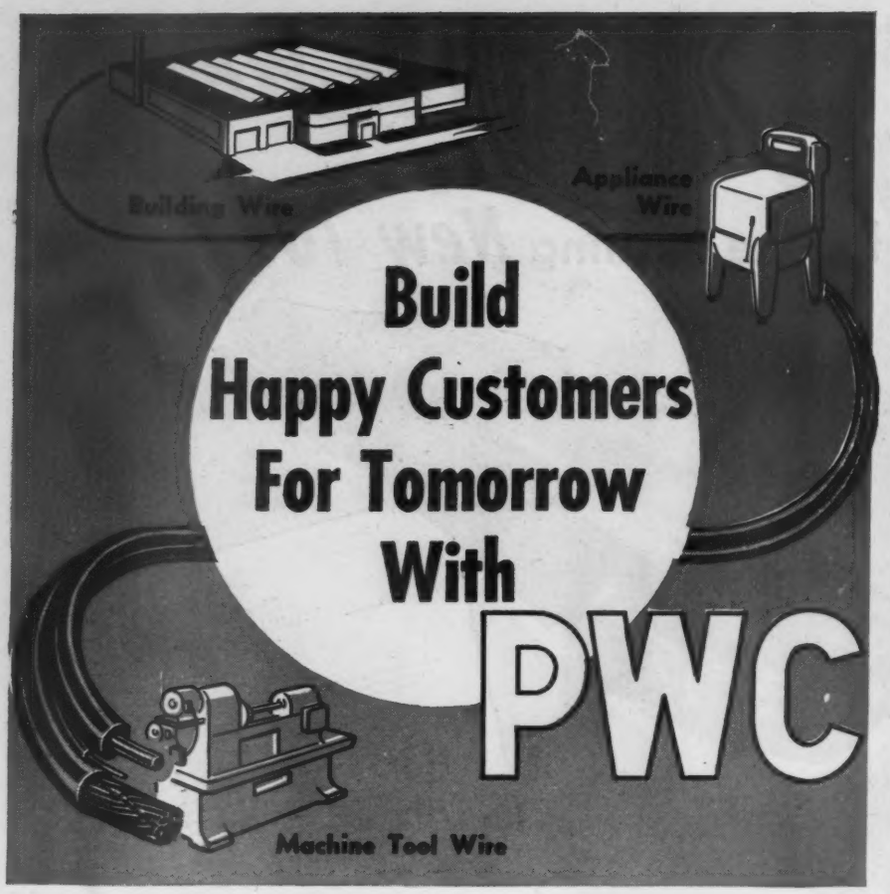
SOLD NATIONALLY THROUGH RECOGNIZED DISTRIBUTORS

FASTENS STEEL TO STEEL
FASTENS STEEL TO CONCRETE
like that!



Whether you're wiring factories, office buildings, machine tools or major or small appliances, the finished job will be better because you have used PWC wires.

For PWC building wires, machine tool and appliance wires (UL approved to 80° C) have insulations that are super-aging, virtually immune to oxidation; that won't support combustion, thus eliminating the fire hazard of ordinary insulation. They're highly moisture resistant, not affected by vegetable, mineral or lubricating oils and greases, and there's no discoloration or corrosion of copper conductors.

Other PWC properties speed work to save labor costs . . . for instance: ease of stripping, pulling through conduits and color coding (up to eight standard colors, others on special order). And smaller diameters permit more wires in a given conduit or space.

Write us your requirements so that we can talk PWC performance on these or other wires or cables in terms of your specific needs.

PWC
PLASTIC WIRE & CABLE CORP.
403 East Main St.
Jewett City
Connecticut

Albert Bonahur, who was recently elected president of the New York Metropolitan Chapter of the National Industrial Service Association, is executive vice president of S. J. O'Brien Sales Corp., New York. Other officers elected were vice president, Stanley Bojak, Standard Electric Motor Co., and treasurer, George R. Lockwood, Lockwood's Electric Motor Service.

Manufacturers are also reaching the point where selling again will be essential intimated Charles E. Wilson, President, General Electric Company. He recommended that utilities continue their planned expansion even in the face of a recession, higher money rates or other temporary deterrent. He does not accept the viewpoint that promotion of electric power use must depend upon the availability of excess generating capacity. For critical areas in temporary trouble, General Electric is recommending such non-load-building programs as modernizing industrial power distribution to reduce losses and improve power factor.

Of his own company's position, Mr. Wilson reported that power transformer facilities are 2½ times prewar capacity; electric heating equipment in all lines is available on short equipment; there is uncommitted capacity in fractional horsepower motors (now 160 competitors compared to 54 prewar.) As of April 1948, 75 percent of general-purpose control items and all standard welding line items are in stock. Unit substation shipments are good and normal conditions on 75 percent of G.E.'s apparatus business has been reached, he revealed.

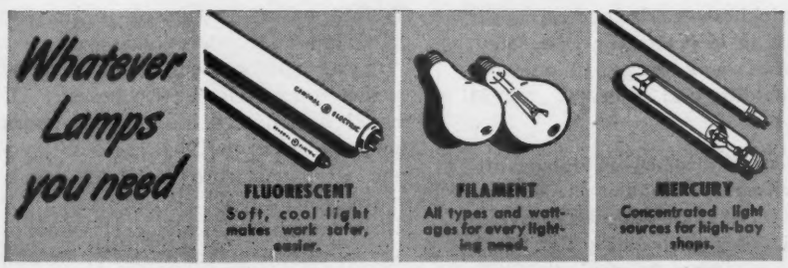
Customer demand for electricity will climb 13½ million kilowatts more in the next four years on top of the 1947 peak load of 49 million, estimated Charles E. Oakes, President of EEI and President of the Pennsylvania Power and Light Company, Allentown. Six billion dollars will be spent for new power production and distribution

Stays bright without cleaning in spite of dirt and smoke

WITH G-E reflector lamps mounted in groups of two to five, dust and dirt accumulation has little effect on light output in the foundry above. No cleaning of lamps is required. Maintenance is reduced to simple bulb replacement on a regular schedule.

The mirrored reflecting surface of the G-E reflector lamp is on the inside of the bulb itself—can't become dull from dirt or tarnish. When mounted base up, airborne material collects on the *sides* of the lamp where it has no effect on light output. Little or no light obstructing material collects on the bottom surface.

With the lamps in clusters of two or more, a burnout need not be replaced immediately; you reduce maintenance costs by making replacements on a regular schedule. G-E reflector lamps are available in 150 and 300 watt sizes.


Whatever Lamps you need
FLUORESCENT
Soft, cool light makes work safer, easier.
FILAMENT
All types and wattages for every lighting need.
MERCURY
Concentrated light sources for high-bay shops.

INFRARED
For drying, baking, curing and other heat processes.
INDICATOR
Glow and filament type. For instruments, etc.
SILVERED BOWL
Indirect lighting at low cost, 60 to 1000 watts.
-G-E makes 'em all

IMPORTANT REASONS *why it pays to insist on G-E when you buy lamps*

1. **Complete line to choose from—over 10,000 types and sizes.**
2. **Quality assured by more than 480 tests and inspections.**
3. **G-E makes all lamp parts.**
4. **Most improvements in lamps and lighting have come from General Electric.**
5. **Services of G-E lighting engineers conveniently available.**
6. **General Electric research works constantly to make G-E lamps** *Stay Brighter Longer!*

G-E LAMPS

GENERAL ELECTRIC

KLEIN

"Pole Master" CLIMBERS*

"solid comfort" for linemen

Gaff is in line with the leg bone.

■ There's greater comfort for the lineman in the *new* Klein "Pole Master" Climbers. Designed as a real working pair . . . with one climber especially for the right and the other for the left . . . they have an extra wide stirrup for greater arch support.

Leg irons are tough and dependable, yet flexible and tapered in width and thickness. Ankles and calves get better support . . . chafing is practically eliminated. And the scientifically offset shank brings gaff in proper line with leg bone, providing real security . . . solid comfort.

"Pole Master" Climbers are forged from high quality, special alloy steel. A wrought, triangular-shaped ring at ankle assures proper set of ankle strap and provides additional comfort . . . safer, longer strap life. "Pole Masters" . . . like all Klein climbers . . . are individually tested and suitable for linemen of any weight.

1945 POLEMASTER CLIMBERS Riveted Top Wrought Loop, Triangular Ring at Ankle (average weight) 2⅛ lbs. per pair. (With this Climber, use Ankle Strap No. 5301-16 or No. 5301-26).

** Matched Right and Left Climbers*

ASK YOUR SUPPLIER

Foreign Distributor: International Standard Electric Corp., New York

Mathias KLEIN & Sons

Established 1857 — Chicago, Ill., U.S.A.

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NISA Convention committee chairmen Fred S. Ferris (Awards) of Boston and E. C. Burke (Program) of Flint, Mich., gather up their files at close of recent Pittsburgh conference.

facilities during this period. To finance this program, utilities must sell nearly $3.9 billion of new securities to investors within the next four years, he added.

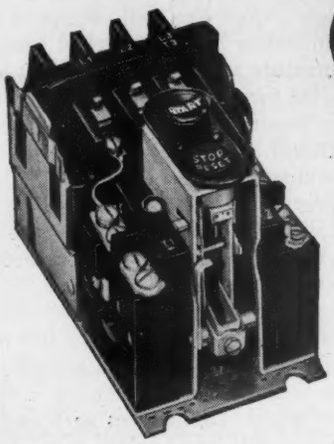
The peace-time expansion program should consider possible needs in preparing for a future conflict, asserted Walker L. Cisler, executive vice-president, The Detroit Edison Company. Such a "defense reserve" (in addition to peace-time requirement) should be built in and form an integral part of the systems, he stated adding that compensation for the added investment, operation and maintenance could be had—in part—by peace-time utilization of power which would not impair its emergency availability. The use of nuclear fuel for domestic, commercial or industrial power purposes will not be realized in the foreseeable future and should not be considered in present day planning, Cisler concluded.

Farms still present a tremendous market for use of electric power. Of the 21 billion, 210 million man-hours spent on farms in 1944, about 60 percent were performed with the hands or small hand tools, revealed Dr. J. O. Christianson, superintendent, School of Agriculture, University of Minnesota. Estimated value of major electrical equipment on U. S. farms in 1943 was $625,000,000. Most of this is found in rural homes and farms and, as yet, has had no appreciable effect on the principal farm machines and tools used in crop production, he added, pointing to the opportunity afforded by mechanization of the farms.

One half of the U. S. farms are without running water, stated M. B. MacNeille, manager, pump division, A. Y. McDonald Mfg. Co., Dubuque, Iowa. An annual $100 million water system market exists that is economically feasible since a farmer can pump 1,000 gallons of water for less than two cents, he pointed out. New dealers

For the advantages of Special Engineering in a STANDARD Manual Starter...

Call for C-H 9115



There is no substitute for experience in *practical* engineering, and users of motor control who want utmost dependability, motor performance and freedom from trouble in STANDARD manual starters, call for Cutler-Hammer 9115. For this starter is *heir* to all the special engineering knowledge gained by Cutler-Hammer engineers in contact with all the control problems of all industry which qualified observers say has no equal.

It was this *special* engineering experience that created the famed Cutler-Hammer "Eutectic Alloy" Overload Relay unequalled for its exact calibrated protection of small motors. It is STANDARD in C-H 9115.

It was *special* experience with *BIG* control that enabled C-H engineers to develop their now famous vertical dust-safe contacts for *SMALL* starters. This construction is *STANDARD* in C-H 9115.

So with all other features of C-H 9115 Manual Starter. Broad experience teaches you things you learn in no other way, and control users who want the utmost in manual starters have thus learned to insist on C-H 9115 and refuse all substitutes. CUTLER-HAMMER, Inc., 1306 St. Paul Ave., Milwaukee 1, Wisconsin. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto, Ont.

CUTLER-HAMMER
MOTOR CONTROL
C-H

OPERATING MECHANISM—Available as skeleton for building into machines, etc. Metal parts rust-proof. Rubber mounting absorbs shocks. Mechanism removable as a unit by loosening one screw—for wiring, etc. Parts and terminals easily accessible.

COVER—"Hook-on" type. Loosening one screw permits lifting off from front. Permits close-fit installation.

CASE—Modern styling and design. Standard NEMA type 1 enclosure. 8 x 4¾ x 4. Japanned steel. Cover can be padlocked. Knockouts top and bottom. Ample space, complete accessibility.

CONTACT STRUCTURE—Designed for compactness, simplicity, strength and accessibility. Unit base construction easily removed. Positive make, quick-break, twin-break silver-to-silver contacts mounted on unit base.

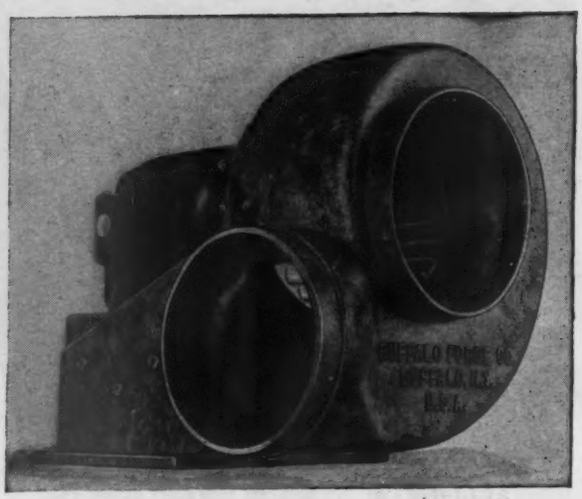
OVERLOAD RELAY—Famous C-H "eutectic alloy" thermal overload relay, most dependable known. Reset by pushing stop button. Free-tripping. Rating changed by changing heater coils.

PUSH BUTTON OPERATION—An achievement for this type of starter. Has start, stop-and-overload reset buttons. Can be locked to prevent unauthorized operation.

DETAILS—Your attention is called to numerous important details such as self-finding terminal screws, unique staking of cover screw, handy spring lifters on movable contacts, etc., etc.

AIR EQUIPMENT TO HELP YOUR BUSINESS

LIGHT — COMPACT STURDY— ADJUSTABLE



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- Efficient for removing gas, moisture, steam, smoke, odors from small areas and hooded vats.
- Handy installation! Easily movable, compact. Readily adjustable discharge positions. Reversible rotation.
- Customer satisfaction! Husky cast iron housing; smooth quiet operation; non-overloading characteristic—all mean longer, more efficient service.

BULLETIN 3222-F DESCRIBES THESE AND OTHER POPULAR "BUFFALO" FANS—WRITE FOR YOUR COPY.

BUFFALO FORGE COMPANY

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Canadian Blower & Forge Co., Ltd., Kitchener, Ont.
Branch offices in all principal cities

FANS BY Buffalo

EQUIPMENT FOR

★ VENTILATING
★ HEATING
★ COMFORT COOLING
★ PROCESS COOLING
★ AIR TEMPERING
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★ BLOWING
★ FORCED DRAFT
★ INDUCED DRAFT
★ PRESSURE BLOWING
★ CLEANING
★ DRYING

CUTTING COSTS IN EVERY BRANCH OF INDUSTRY

Recently elected to the Board of Directors of the National Industrial Service Association were: (L to R) John E. Launder, Kansas City, Mo. (Region 12); T. M. Russell, Mobile, Ala. (Region 6); C. R. Durand, Allentown, Pa. (Region 3; B. C. T. Elworthy, Vancouver, British Columbia (Region 15). Joseph F. Ferrari of Chicago (not in photo) represents Region 9 on the Board.

need training to sell engineered adequate capacity systems, he concluded.

One means of assuring adequate electrical capacity and equipment in new homes is to use the "Package Mortgage". Complete, fully-equipped homes (including house, electrical equipment, furniture and other needs) can be provided for the family of average income by means of this plan, stated Horace Russell, general counsel, United States Savings and Loan League, Chicago. Everything is wrapped up in a single package and financed in one transaction with a single monthly payment well within the family budget. The veterans' loan program has been adjusted so this can be done up to 100 percent of cost and more than $6 billion has been made available under it, Russell revealed. He believes packaged mortgages for completely equipped homes would eliminate the unduly heavy monthly payments normally required to pay off about $1,000 worth of electrical and other equipment in the conventional two year period.

To acquaint the American family with the advantages of electrical living and to encourage more homes to "go all-electric", E. E. I. has prepared a Kitchenizing promotional and educational program. It is to be used by utilities and local elements of the electrical industry to encourage sale of electric kitchens in new homes and home modernization markets. It will supplement manufacturer's national brand advertising.

Spearhead of the program will be a 40-page book "Kitchenizer's Digest" proclaimed to be the most authoritative and complete book on the all-electric kitchen (includes planning, purchasing, wiring, layout and smaller

It's a snap to install SNAPICOIL (WIREMOLD'S LATEST)

THE *NEW* COIL OF READY-WIRED OUTLETS THAT GIVES YOU ADEQUATE WIRING BY THE YARD

Yes, here's an exclusive WIREMOLD development that's really a time-saver . . . a business-builder . . . the new answer for wiring homes, apartments, hotels, stores, factories . . . wherever plenty of convenience outlets are needed.

SNAPICOIL consists of standard No. 1927 receptacles (UL listed) wired at the factory with two No. 12 Type R conductors (UL labeled) . . . available in four lengths to meet the requirements of every job.

Here are the simple steps that mean quick, easy installation . . .

1 Make feed connection (here it was with a No. 1914A). Attach regular 1900 base to wall.

2 Then, starting at feed end, snap wiring harness into place, one receptacle at a time . . .

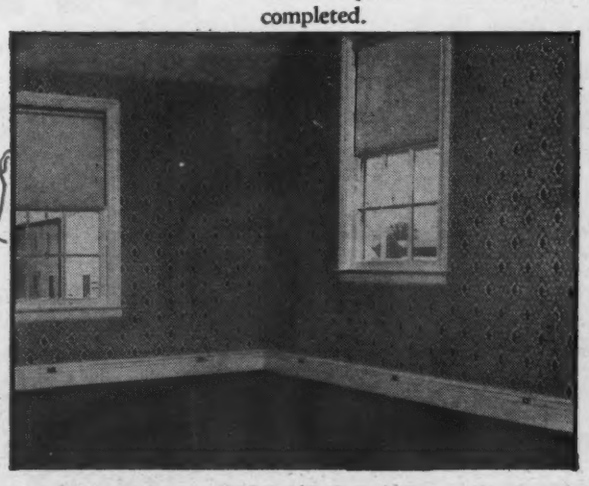
3 After snapping in each receptacle, snap on factory-cut cover section preceding each receptacle. Continue until run is completed.

I say SNAPICOIL GIVES

LASTING
CUSTOMER
SATISFACTION

WRITE TODAY for complete information on SNAPICOIL

THE WIREMOLD COMPANY
HARTFORD 10, CONNECTICUT



BOWMAR

Sold through ELECTRICAL WHOLESALERS . . . *Installed by* ELECTRICAL CONTRACTORS . . . *Everywhere*

installation time: 5 minutes!

FRANKEL INSULATED GUTTERTAP

...faster to install! Because insulated cover clamps on in a second without screws . . . bothersome, costly taping is eliminated. Fastenings of connector and cover are accessible . . . always on the side facing the electrician.

•

...easier to install! Because it's so compact! . . . small enough to solve the tough installation problem of tight working space. It's easier, too, because tap can be taken either from right or left of main cable.

•

costs less! On larger sizes, guttertaps show a saving of up to 33⅓% over split-bolt connectors.

- Available in full range of sizes to fit any combination of wires from 1000 MCM through No. 14.
- All underwriter approved, of course!
- Engineered for quality and dependability — priced for economy.

•

Write today for your copy of catalog 4C

It's easier and faster when you use Frankel Solderless Connectors

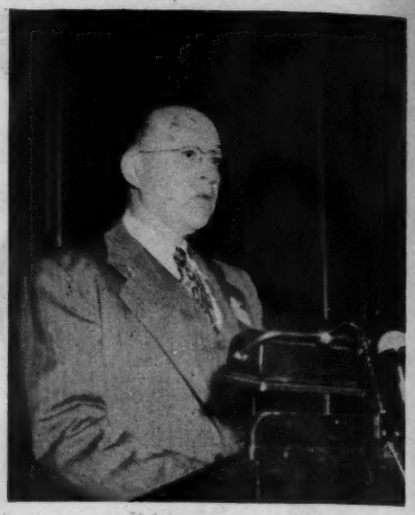
Sold Through Leading Wholesalers Exclusively

Frankel Solderless Connectors

FRANKEL CONNECTOR CO.

27 Vestry St., New York 13, N. Y.

42 YEARS OF KNOW-HOW IN SOLDERLESS CONNECTORS



Be sure you have adequate insurance coverage, David Sandman, Sandman Electric Co., Inc., Boston, cautions motor shop men at recent NISA convention in Pittsburgh.

appliances). Kitchen planning kits and other promotional aids will supplement the book. The plan was introduced at the conference by H. H. Brenan, Pennsylvania Power and Light Co., T. O. McQuiston, Duquesne Light Co., and H. E. Warren, The Ralph H. Jones Company, New York City.

Norman Tindal, a commercial lighting representative of the Duke Power Company, Charlotte, N. C., won first prize in the Augustus D. Curtis Commercial Lighting Award for the outstanding commercial lighting installation during 1947. H. M. Sawyer, chairman, EEI Awards Committee presented Mr. Tindal with his certificate and $200 purse. D. E. Romberger, Luzerne County Gas & Electric Corp., Kingston, Pa., received the $100 second prize. Third and fourth prizes ($50 and $25) went to L. T. Kight, Duquesne Light Co., Pittsburg and F. O. Evans, Indianapolis Power and Light Company.

Judges in the 1947 Curtis Award Contest were James Krieger, editor and publisher, *Lighting and Lamps;* Marshall N. Waterman, Electrical Testing Laboratories Inc., and Berlon C. Cooper, eastern editor, *Electrical Construction and Maintenance.*

The Thomas W. Martin Farm Electrification Award (an engraved bronze plaque) was presented to the Alabama Power Company for its contribution to progress of farm electrification and to general agricultural development in its area during 1947. This company also won the award in 1932 when the Martin Award was established. Honorable Mention awards were given to the Texas Power and Light Company, Dallas, Texas, and the Pacific Gas and Electric Company, San Francisco, California.

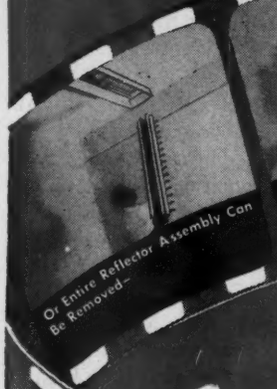
The Amazing New and Different

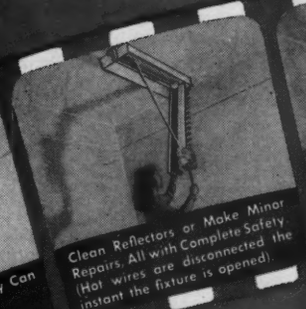
Guthlite*

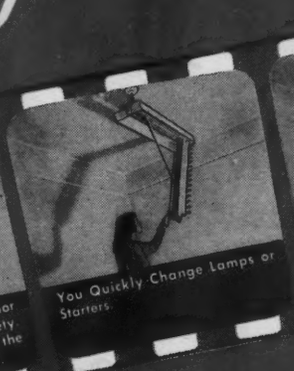
FEATURES FAST, SAFE, EASY "JACKNIFE" MAINTENANCE!

With a Twist of the Wrist –

EVERYTHING — Lamps, Starters, Reflectors, Louvres, Ballast, Wiring

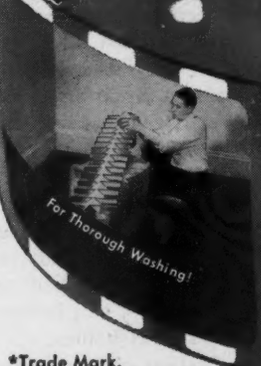

Or Entire Reflector Assembly Can Be Removed –


Clean Reflectors or Make Minor Repairs, All with Complete Safety. (Hot wires are disconnected the instant the fixture is opened).


You Quickly Change Lamps or Starters.

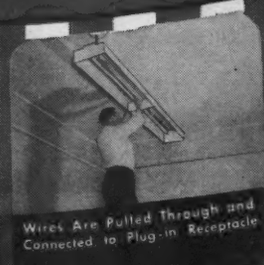
– Is At Your Fingertips!

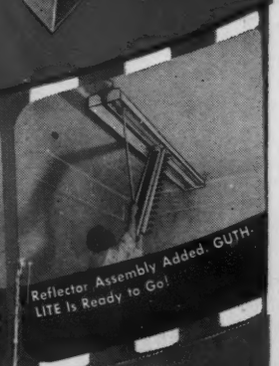
The Exclusive GUTH "JACKNIFE" HINGE Makes This Revolutionary New Fixture Possible


For Thorough Washing!

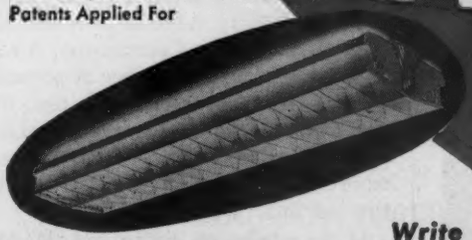
GUTH-LITE Installation Is Simple, Quick, Economical!

Light Weight (10 lbs.) Channels are Mounted on Ceiling or Stems.


Wires Are Pulled Through and Connected to Plug-in Receptacle.


Reflector Assembly Added. GUTH-LITE Is Ready to Go!

*Trade Mark.
U. S. & Canadian Patents Applied For



GUTHLITE . . . for Better Sight

The GUTHLITE provides efficient down light, comfortably pleasing ceiling light, and beautiful, "radiant glow" soft lighted sides. There is no glass used in the fixture — and no horizontal light-reflecting surfaces to gather dust.

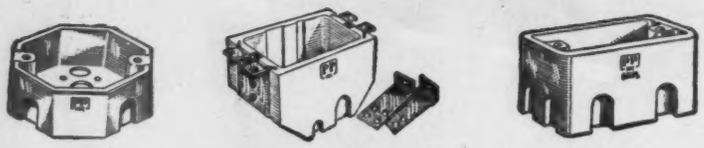
For Full Details Ask for Bulletin No. 2845C

Write Today

THE EDWIN F. GUTH CO. · ST. LOUIS · *Leaders in Lighting Since 1902*

Guth

PORCELAIN
OUTLET
SWITCH
and
READY
BOXES



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DELIVERY

Phone or wire your jobber! If he does not have them in stock for immediate shipment, we will ship to you at once for him.

PORCELAIN PRODUCTS, INC.
FINDLAY, OHIO

Engineers See Vast Power Increase

A glimpse of the green pastures on the other side of the power shortage fence was given engineers from all over the midwest area at the recent 10th Annual Midwest Power Conference held in Chicago's Sheraton Hotel. Growing use of electricity for production and for convenience or luxury has inspired predictions of an increase of 40 million kilowatts of installed capacity in the United States in ten years and 200 million kilowatts in 30 years, A. C. Monteith, director of education, Westinghouse Electric Corp., told the assembled engineers. Generating and distributing these vast amounts of power are the problems facing the nation, he added.

Not only is the nation's power generation capacity significant, but power consumption is what determines our size and economic stature, F. R. Benedict, manager, industry engineering, Westinghouse Electric Corp., told the group. Reviewing the growth of power consumption, Mr. Benedict revealed that of the 7.2 horsepower backing up the American worker today, about 93 percent is electrical power. Back in 1909, about 69 percent of the 2.9 horsepower per worker was mechanical. Increased labor costs is making industry favor application of highly specialized automatic machinery to industrial processes, he pointed out.

After this year, rural hi-line building will have to slow down, stated Grover C. Neff, president, Wisconsin Power and Light Co., Madison. By the end of this year about 5,025,000 of the 5,600,000 farms in the United States will have been reached by electric service. From here on in it will be electrification of the farmstead. In 1947, electric light and power companies sold at retail over six billion kilowatthours to their farm customers plus about two billion kilowatthours wholesale to electric co-ops.

Mr. Neff predicted a new market for the heat pump. It is ideally adaptable to farm use, especially in heating and cooling boiler houses, hen houses, livestock barns and farm homes.

Further investigation of heat pump advantages and limitations was made by M. S. Oldacre, director of research, Utilities Research Commission, Chicago. While most reference at present is being made to residential use, he added that there are numerous industrial applications that may be of greater importance, especially from the standpoint of fuel conservation.

At the session on electronics, M. M. Morack, General Electric Company, reviewed the application of electron-

Wanted...a Compass

THE world gropes for a road to peace and security. It expects help and guidance from America--a compass to show the true way.

America *has* a true compass. It is our concept of freedom for the individual. Personal liberty has made us the envy and hope of the peoples of the earth. *You, as a community leader,* have a duty to marshall public opinion to guard and strengthen this priceless heritage that built our nation.

Only through the wise, courageous effort of community leaders can we keep America the impregnable home of liberty and freedom, and reach a lasting world peace founded on right and justice.

The Youngstown Sheet and Tube Company

General Offices--Youngstown 1, Ohio
Export Offices--500 Fifth Avenue, New York

MANUFACTURERS OF CARBON, ALLOY AND YOLOY STEELS

COLD FINISHED CARBON AND ALLOY BARS - SHEETS - PLATES - WIRE - TIE PLATES AND SPIKES - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - PIPE AND TUBULAR PRODUCTS - CONDUIT - BARS - RODS.

2 new appliance testers.....

by Simpson

MODELS 391 and 392

A. C. – D. C. VOLT-WATTMETERS

. . . for fast-simultaneous reading of volts and watts

These two Simpson testers are designed for simultaneous reading of volts and watts. Each has two separate 3" square meters, one for volts and one for watts. Each has built-in cord and plug for connecting to line outlet, and receptacle for connecting appliance under test. There are no leads to connect. Readings register immediately when plugs are connected. Separate, uncrowded scales make quick, accurate readings easy. Each meter has two ranges, selected by separate toggle switches with positions clearly indicated by white figures recessed in the molded bakelite case. The low power consumption of these instruments and their high efficiency result in negligible loss and error in reading.

Leatherette Carrying Case—$5.00

Model 391 (3000 watts max.)
Ranges, A.C. or D.C.
Volts: 0-130, 0-260
Watts: 0-1500, 0-3000
Size: 3" x 5⅞" x 2½"
Weight: 2 lbs.
Shipping Weight: 3 lbs.
Dealer's Net Price.....$30.00

Model 392 (5000 watts max.)
Ranges, A.C. or D.C.
Volts: 0-130, 0-260
Watts: 0-1000, 0-5000
Size: 3" x 5⅞" x 2½"
Weight: 2 lbs.
Shipping Weight: 3 lbs.
Dealer's Net Price.....$35.00

SIMPSON ELECTRIC COMPANY
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London, Ont.

ically controlled adjustable speed drives. Suitable rectifying devices and power circuits have now been developed which permit a new approach to adjustable speed motor drive problems.

Discussing rectifier power supplies for d-c systems, C. R. Marcum, Westinghouse Electric Corp., asserted that such equipment has practically outmoded rotating conversion units except where regeneration at low d-c voltages and power factor correction are required.

There is nothing miraculous about electronic controls, according to Walther Richter, Allis-Chalmers Mfg. Company, Milwaukee. Electronics has simply put at the disposal of the electrical engineer two new control elements, one of them essentially a switch, the other an electrical rheostat.

At the session on conductors, John T. Blake, director of research, Simplex Wire and Cable Co., Cambridge, Mass., reviewed the progress made in synthetic insulations during the past ten years. To date Teflon (a Dupont synthetic similar to polyethylene except that hydrogen atoms are replaced with fluorine) comes closest to the perfect dielectric, he revealed. However, its cost is high and it is difficult to process. Blake warned that none of the synthetics is perfect as insulation, but each has its place.

Interesting research work on copper wire connections is being conducted by the Copper Wire Engineering Association. Frank E. Sanford, director of research and development, reported on laboratory investigations now under way. Investigations at present confined to overhead lines reveal:

1. Conductivity of a mechanical connector should equal that of the conductor.

2. Connectors should meet a performance type of specification based on resistance requirements.

3. High resistance between individual strands and layers of strands in one conductor, rather than high joint resistance between conductors alone, is a principal source of fault trouble.

4. To withstand fault current conditions, a positive pressure low resistance contact must be established to and between all strand wires at connection.

5. Higher connection pressures are required for maintenance of contact surfaces than are needed to establish initial contacts on clean wire.

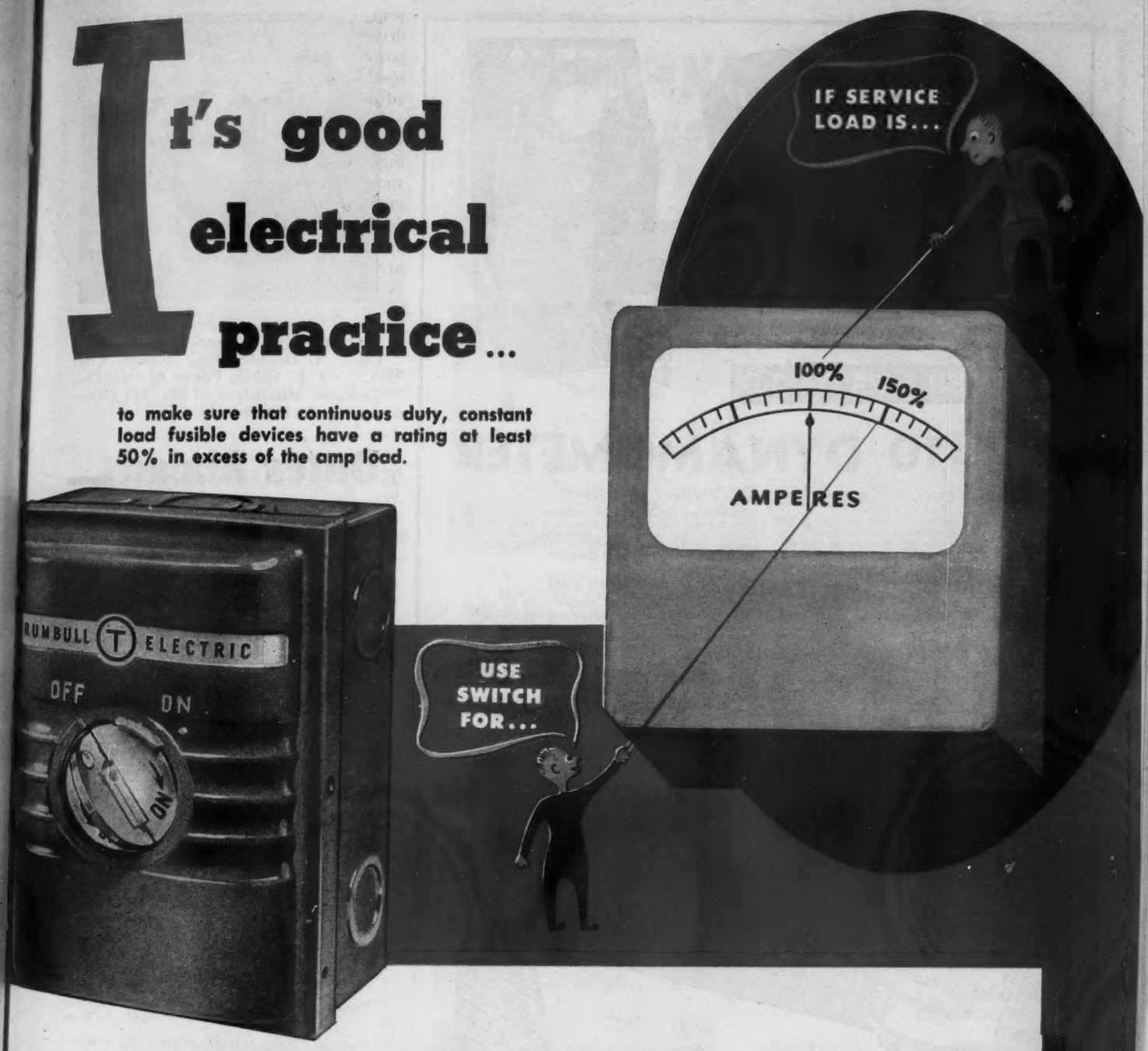
6. Cleaning of connection surfaces of conductors in service should be adapted as a regular practice.

7. A chemical cleaning grease or paste for practical overhead line use should be developed to replace acid solution or scraping methods.

8. An oxidation inhibitor or sealing treatment, not water miscible, is desirable in preserving connections.

It's good electrical practice...

to make sure that continuous duty, constant load fusible devices have a rating at least 50% in excess of the amp load.



It's good Electrical Practice

... to use a Trumbull Type D Enclosed Safety Switch for entrance service and general purposes. Its 30 amp capacity is more than adequate for such duties as controlling small motors.

Front operated, the Trumbull Type D switch has a sturdy, *"KING-SIZE" HANDLE* . . . more than *AMPLE WIRING SPACE* . . . double break, *SILVER TO SILVER CONTACTS* under heavy pressure . . . contacts fully enclosed for protection of operators, and holes provided for sealing by power company. With its modern streamlined design, the Type D is the switch of tomorrow — *today.*

Safety switches or switchboards, motor controls or control centers, branch circuit distribution systems or main feeders . . . it's always good electrical practice to specify Trumbull, the name that safeguards *your* safe practice. THE TRUMBULL ELECTRIC MANUFACTURING CO., Plainville, Conn. Other factories and offices throughout the United States. Foreign representation.

MEN WHO OBSERVE THE BEST PRACTICES MAKE IT A PRACTICE TO USE **TRUMBULL**

TRUMBULL (T) ELECTRIC

"GOODBYE" guesswork MOTOR TESTING!

WHEN YOU USE THE

POTTER & RAYFIELD

DM-10 DYNAMOMETER

● *No guesswork*

The DM-10 Dynamometer accurately and quickly checks all operating characteristics of electric motors. Costly comebacks are eliminated and customer satisfaction assured.

● *Testing range*

From 1/10 to 3 HP at 1750 RPM. Speed range from 600 to 4000 RPM. Maximum rated running torque 10 foot pounds.

● *Larger units available*

Capacities to 45 foot pounds. All units completely self-contained, ready for connection to power sources. Write for detailed descriptive bulletins.

● *Accurate indication*

Indicates full load, pull-in, pull-out and locked rotor torques. Accurate indication of load shown directly in foot-pounds on calibrated gauge, regardless of direction of rotation. Current values, voltage and RPM are also indicated.

● *Load absorption unit*

Consists of two aluminum discs rotated by motor under test in a magnetic field of variable intensity. Adjustable magnetic table holds motor firmly under high torque.

POTTER & RAYFIELD, INC.

ENGINEERING
CRAFTSMANSHIP

P. O. BOX 1042C ATLANTA, GA.

THE MAGNOTRONIC FLUORESCENT STARTER

Licensed under U. S. PATENTS
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OTHER PATS. PENDING

PROTECTS—Fully automatic thermal relay with unusually long life that eliminates blinking lights and protects all auxiliary equipment.
SIMPLIFIES—Replacement of worn-out lamp automatically restores closed circuit—replacement of starter unnecessary—no button to push.
REDUCES COSTS—Magno-Tronic starters provide exact timing in the lamp electrode—preheating process preventing excessive loss of emission material thereby assuring the maximum in the useful life of a lamp. The established quality of this starter saves considerable time in maintenance and man hours required to repair and/or replace an inoperative lighting unit.
VERSATILE—Will operate efficiently over an extended voltage range under widely varying temperatures.

Guaranteed for one year. Write for descriptive literature.

The (SP-15-20) for use with either 15 or 20 watt lamps
The (SP-30-40) for use with either 30 or 40 watt lamps
The (SP-100) for use with 100 watt lamps

Ask for descriptive literature

INDUSTRIAL ELECTRONICS CORP.

MAIN PLANT Newark 2, N. J.

Norvel Ogden, Power Electric Co., Jackson, Miss.; Charles A. Buckley, Chas. A. Buckley Co., Atlantic City, N. J.; J. E. Smith, Power Electric Co., Jackson, Mississippi at the NISA Conference in Pittsburgh.

Dates Ahead

Illuminating Engineering Society—Great Lakes Regional Conference, Hotel Statler, Detroit, Mich., June 16-18.
American Society for Testing Materials—Annual Meeting, Book-Cadillac Hotel, Detroit, June 21-25.
New York State Association of Electrical Contractors and Dealers, Inc.—Annual Convention, Saranac Inn, N. Y., June 27-July 3.
Cold Cathode Fluorescent Lighting Exhibit—Grand Central Palace, New York City, July 6-10.
American Institute of Electrical Engineers—Summer General Meeting, Palace of Fine Arts, Mexico City, Mexico, June 21-25.
Second International Store Modernization Show—Grand Central Palace, New York, N. Y., July 6-10.
International Association of Electrical Inspectors—Western Section, Denver, Colo., September 13-15; Northwestern Section, Salt Lake City, Utah, September 20-22; Southwestern Section, Oakland, Calif., September 27-29; Eastern Section, October 11-13; Southern Section, Heidelberg Hotel, Jackson, Miss., October 18-20.
Illuminating Engineering Society—National Technical Conference, Boston, Mass., September 20-24.
Electrical Contractors Society of Washington States—Annual convention, Everett, Wash., September 25-26.
International Municipal Signal Association—53rd Annual meeting, Hotel Statler, Buffalo, N. Y., October 4-7.
Porcelain Enamel Institute—Annual forum, University of Illinois, Urbana, Ill., October 13-15.
National Association of Housing Officials—Third annual exhibit of building and maintenance products, Olympic Hotel, Seattle, Wash., October 13-16.
National Electronics Conference—Edgewater Beach Hotel, Chicago, Ill., November 4-6.
National Electrical Manufacturers Association—Traymore Hotel, Atlantic City, N. J., November 8-13.
Electrical & Gas Association of New York, Inc.—Luncheon meeting, Grand Ballroom, Hotel Astor, New York, N. Y., November 17.
National Electrical Contractors Association—47th Annual Meeting, Roney Plaza Hotel, Miami, Fla., November 30-December 3.
Electrical & Gas Association of New York, Inc.—Luncheon meeting, Grand Ballroom, Hotel Astor, New York, N. Y., December 22.
Independent Electrical Contractors Association, Inc.—43rd Annual dinner, Hotel Astor, New York, N. Y., January 15, 1949.
American Institute of Electrical Engineers—Winter general meeting, Pennsylvania Hotel, New York, N. Y., January 31-February 4, 1949.
National Electrical Manufacturers Association—Winter convention, Edgewater Beach Hotel, Chicago, Ill., March 13-18, 1949.
Third International Lighting Exposition and Conference—Hotel Stevens, Chicago, Ill., Week of March 28, 1949.

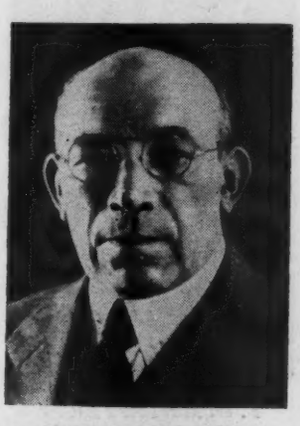
Harry G. Bedig and Herbert Jacobson, Electric Maintenance Co., Boston, Mass. discuss highlights of the NISA Convention program.

Manufacturers News

WESTINGHOUSE APPOINTMENTS

The election of D. W. R. Morgan, of Philadelphia and John K. Hodnette, of Sharon, as vice president and E. V. Huggins, of New York, as secretary of the Westinghouse Electric Corporation, has been announced.

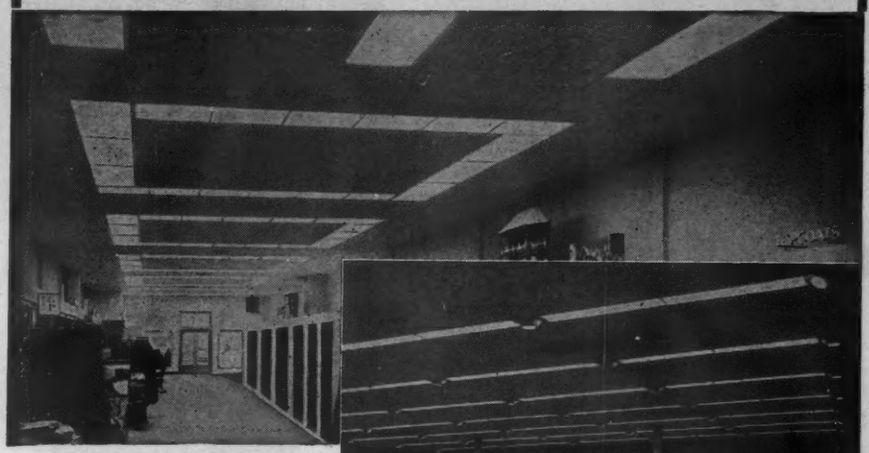
Mr. Hodnette will retain his post as manager of the company's transformer division, a responsibility he assumed



D. W. R. MORGAN

J. K. HODNETTE

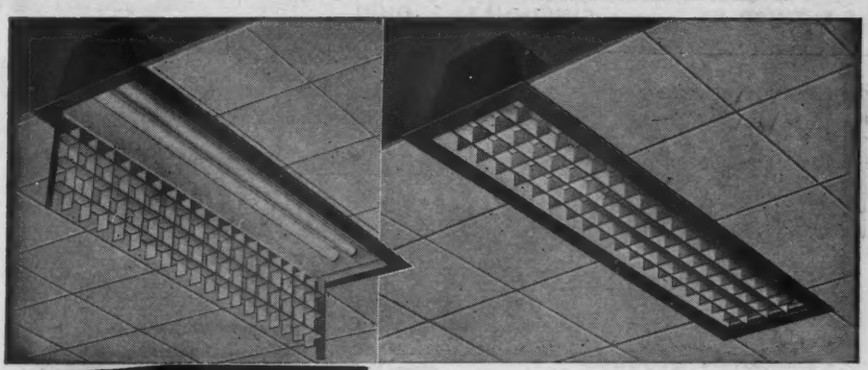
PLANNED LIGHTING WITH WILEY RECESSED TROFFERS



Wiley Recessed Troffers in unusual patterns

Wiley stock model Recessed Troffers provide custom-made results both in lighting requirements and flexibility of arrangement to fit any architectural plan *without* custom-made costs.

Wiley Recessed Troffers Combined with "Spots" in continuous runs.



Only Wiley has the
E-Z SERVICER
Pat. #2427084

One-man service . . . No Tools. Raise one side, slide sideways and drop open. Unhook to completely remove.

FEATURES, UNIVERSAL UNIT:

- Adaptable to any position.
- Individual or continuous runs or patterns.
- Open, louvered or glass.
- May be combined with Wiley Spots.
- 2, 3 or 4 lamps—Starter or Instant Start.
- Underwriters Approved.
- I.B.E.W. Label

Other WILEY Fixtures:

NIAGARA FLEUR-O-LIERS: 2, 3, 4 or 6 lamps, louvered or glass bottoms. May be suspended from or mounted flush to ceiling, singly or in continuous runs.

NIAGARA BEAM: 2, 3, or 4 lamps, louvered or glass. Flush to ceiling — Singly or continuous runs.

SPOTS: Adjustable or fixed lens. May be used individually or combined with Wiley Commercial or Troffer models.

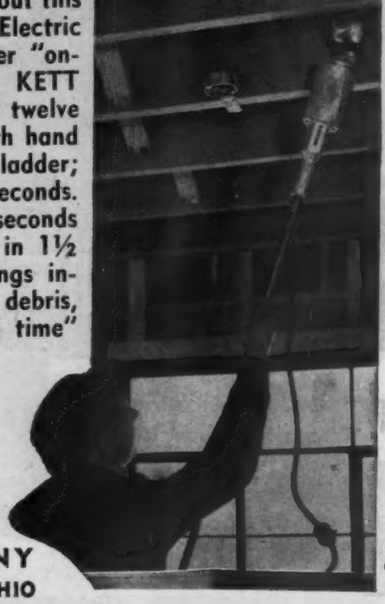
INDUSTRIAL FLUORESCENTS: Complete high quality line, open, louvered or glass bottoms.

R. & W. WILEY, INC.

Dearborn at Bridge Street — Buffalo 7, N.Y.

CONTRACTOR TESTS KETT TALL REACH BORER...

SLASHES DRILLING TIME 76%...



"... an electrician ... cannot afford to be without this tool," says the Frey Electric Co., Cincinnati, after "on-the-job" tests with KETT Borer. In one test, twelve joists were bored with hand brace and bit and ladder; time per hole, 21 seconds. With the "Tall Reach" Borer, time: 5 seconds per hole. A 4½ hour hand job drilled in 1½ hours. This user states that other savings include: easy mobility over house-building debris, absence of fatigue, no wasted "waiting time" for master electrician and ease with which trainees learn correct hole boring.

See your distributor or write for Bulletin F-6

THE KETT TOOL COMPANY
5 E. THIRD ST. CINCINNATI 2, OHIO

SALI INSULATING BUSHINGS for LONG, HARD SERVICE

- Insure against power failures
- Eliminate grounds and shorts
- Meet requirements of 1947 Code
- Accurately machined —not molded
- Strong, tough, resilient
- Complete range of sizes
- All types—male, female, threadless

If you are not already using SALI Bushings, ask for free sample.

THE ADALET MANUFACTURING CO.
14300 LORAIN AVE.
CLEVELAND 11, OHIO

in 1946. Mr. Morgan will continue to direct operations at the Westinghouse South Philadelphia Works.

GENERAL ELECTRIC APPOINTMENTS

John J. Huether has been named manager of the transportation division, a new industry sales division of the General Electric Company's apparatus department.

Charles W. Maledon has been appointed southwestern district manager of construction materials sales.

Organization of G-E's welding equipment divisions, announced recently as one of 16 businesses in the company's apparatus department with headquarters at Schenectady, N. Y. has been completed. The management function of the Divisions is performed by the Welding Equipment Committee, composed of A. F. Vinson, chairman, C. I. MacCuffie, and F. P. Wilson, Jr.

H. M. Jalonack has been appointed manager of sales planning in the transformer and allied product divisions.

TRUMBULL ELECTRIC APPOINTMENTS

Taylor D. MacLafferty has been appointed manager of marketing of the Trumbull Electric Manufacturing Company, Plainville, Conn. In this new capacity, Mr. MacLafferty will

T. D. MacLAFFERTY

have over-all responsibility for the operations of the field sales, product sales, marketing services and advertising divisions of the company.

Carl H. Krause has been named works manager of the newly established New York Works, located at 53-06 Grand Avenue, Maspeth, L. I.

WESCO CHANGES

The Westinghouse Electric Supply Company is splitting the present Northwestern district and a new district is being formed to be known as Western district No. 19 with headquarters at 117 No. 13th Street, Omaha, Nebraska.

The following houses will be included

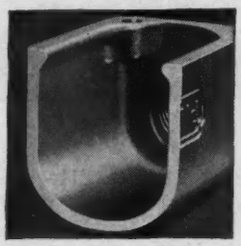
standardize on...

PYLETS

A Modern Line of Improved Heavy-Duty Conduit Fittings

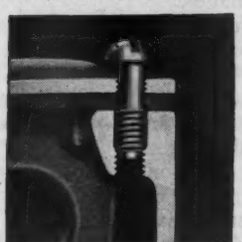
PYLET PRACTICAL DESIGN FEATURES

Accurate, malleable iron castings made in Pyle-National's own foundry. Double weather-proof protection—first, galvanized, and then finished with baked sprayed aluminum.



Smooth interiors, round edges and large wiring spaces prevent damage to wires. Ribbed sidewalls provide extra strength.

Strong Domed Covers are warped and Body Cover Joints are ground flat for tight gasket seal. Heavy hub sections of ample cross section are tapped straight and true with accurate, cleancut, TAPERED threads.



Dowl-pin type self retaining screws provide easy alignment of covers—hold cover and gasket together during handling.

A Full Range of Types and Sizes for Industrial Wiring

1

2

3

4

5

1. FS AND FD PYLETS AND COVERS—1, 2, 3 and 4 gang, square corner types, take all standard switch and receptacle plates.

2. ROUND BASE PYLETS AND COVERS—Ideal for Vaportight junction boxes—Flush and surface mounting. Take standard 4-inch outlet box cover; also vaportight fixtures, plug receptacles and Flexible fixture hangers.

3. VAPORTIGHT LIGHTING FIXTURES—With heavy cast metal bases, weathertight sealing and sturdy guards. Complete line, for 10 to 200 watt lamps, for conduit or wall mounting, universal 4 and 5 hub types, two and three gang, handrail and outlet box types, also midget fixtures.

4. FLEXIBLE FIXTURE HANGER PYLETS—Universal joint hub allows easy removal of fixture, free swing movement of fixture with stop to prevent wire injury, also cushion type for protection against vibration. Also rectangular Pylets with suspension hanger.

5. CAST METAL SAFETY SWITCHES AND CIRCUIT BREAKER PYLETS—Heavy duty safety switches and fuse boxes with or without plug receptacles and circuit breaker Pylets with all features for reliable service under severe conditions. Safety switches have quick make and break, interlocked cover and weathertight gaskets on both cover and hub plates. Available with interlocking plug receptacles.

Refer to your Pylet Catalog 1100 for complete listings including plugs and receptacles—explosion-proof pylets, cord and cable grips—flexible conduit couplings—unions—reducers—elbows and grip handles—portable hand lamps.

THE PYLE-NATIONAL COMPANY

1344 NORTH KOSTNER AVENUE, CHICAGO 51, ILLINOIS

Offices: New York • Baltimore • Pittsburgh • St. Louis • San Francisco • St. Paul • Cleveland
Export Department: International Railway Supply Co., New York
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SINCE 1897

PLUGS and RECEPTACLES • FLOODLIGHTS • TURBO-GENERATORS • LOCOMOTIVE HEADLIGHTS • MULTI-VENT AIR DISTRIBUTION

PARTS FOR FANS MOTORS CONTROLS

PROMPT SHIPMENT FROM LARGE STOCK

AUTHORIZED PARTS DISTRIBUTOR

Brown-Brockmeyer	General Electric	Master
Century	Hamilton-Beach	Peerless
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READING ELECTRIC COMPANY, INC.

Parts Distributors for the Manufacturer

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Talk it over.... IN CONFIDENCE!

The privacy you get on a desert island is yours when you use a Couch private telephone system. Systems range from two-station lines to manual — or automatic — switchboard installations.

Whatever your inter-communicating problem, Couch equipment will solve it with quick, dependable and economical service. Talk it over in confidence with Couch equipment.

Couch

Free Illustrated Catalog

S. H. COUCH COMPANY, INC.

DEPT. 806 NORTH QUINCY 71, MASS.

PRIVATE TELEPHONES for HOME and OFFICE . . . HOSPITAL SIGNALING SYSTEMS . . . APARTMENT HOUSE TELEPHONES and MAILBOXES . . . FIRE ALARM SYSTEMS for INDUSTRIAL PLANTS and PUBLIC BUILDINGS.

in the new district: Omaha, Neb.; Davenport, DesMoines, Waterloo, Sioux City and Cedar Rapids, all of Iowa.

E. E. Morton, formerly district appliance manager of the Northwestern district, has been appointed district manager.

The Northwestern district, with Henry Czech as district manager, will include the following houses: Chicago, Peoria and Rockford, Ill.; Indianapolis and Fort Wayne, Ind.

H. J. NEWTON ELECTED VICE PRESIDENT

Harold J. Newton, sales manager of National Electric Products Corp., Pittsburgh, has been elected a vice president of the corporation.

Mr. Newton went to Pittsburgh in 1929 as eastern district sales manager

H. J. NEWTON

for National Electric. He was transferred to San Francisco in 1931 and became western sales manager in charge of eleven western states. In 1943, Mr. Newton was appointed sales manager of the corporation and returned to the general offices in Pittsburgh.

U. S. RUBBER CO. APPOINTMENTS

The wire and cable department of United States Rubber Company has announced the appointment of Howard H. Weber as chief engineer of the department and A. S. Basil general sales manager.

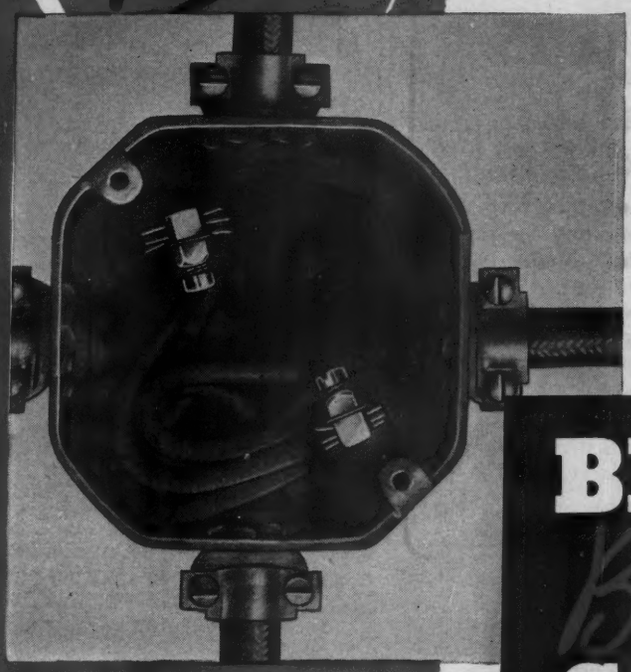
Mr. Basil has been associated with the company since 1926 and Mr. Weber since 1934.

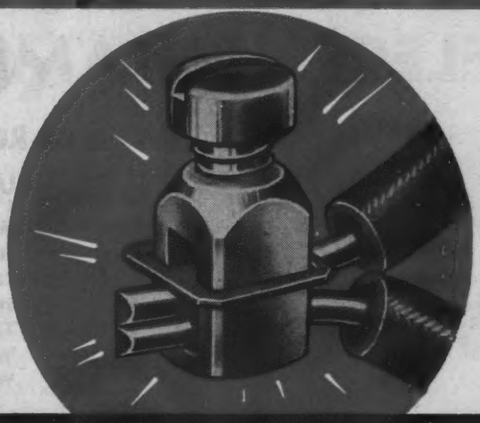
Other changes announced by C. W. Higbee, manager of the department, are as follows:

H. J. MacDonald, assistant to the manager; H. F. Johnson, assistant general sales manager; R. A. Walker, merchandise manager; J. A. Leuver, assistant sales manager in charge of distribution; D. B. Karlskind, assistant sales manager in charge of commodities, sales engineering and new proj-

NEW- and only a Nickel!

An Approved Building Wire Connector for Any Indoor Use!





3 Sizes cover a wide range of #14 to #4

BLACKBURN *Building Wire* CONNECTOR

Where to Use It:

In Junction Boxes

For Connecting Motor Leads

For Connecting Light Fixtures

For Connecting Electric Ranges

For Any Indoor Wiring

FULLY APPROVED BY UNDERWRITERS' LABORATORIES

Order from Your Jobber Today:

Catalog Number	Wire Sizes Minimum	Wire Sizes Maximum	Standard Package	Shipping Weight per 100
10U	2 #14	4 #14 3 #12 2 #10	100	1 lb.
6U	2 #8	3 #8 2 #6	100	2 lb.
4U	2 #6	2 #4	100	3 lb.

HERE'S an efficient, inexpensive connector that will connect 2 #10, 2 or 3 #12, and 2, 3, or 4 #14. This popular size costs less than 5c. Two additional sizes cover #8, #6 and #4 wires. Self-contained washer prevents set screw from cutting into wires.

The BLACKBURN Building Wire Connector is ideal for motor leads and junction boxes, because connections may be changed without clipping off the old pigtails — you merely remove the connector and rearrange the wires.

This new connector is easy and quick to install, and easy to remove for re-connections or wire changes. It's small, compact, and easy to tape. Economical, too—because it saves the labor of soldering.

WRITE TODAY FOR SAMPLES

JASPER BLACKBURN PRODUCTS CORP.
FIRST, MADISON & CLINTON STS. • ST. LOUIS 6, MO.

FAST — ECONOMICAL

Drilling — Cutting and Chipping in Concrete and Masonry

with

SYNTRON

DEPENDABLE

ELECTRIC HAMMERS

Electromagnetic design—no motors, gears, cams, eccentrics. Only One Working Part —the Piston.

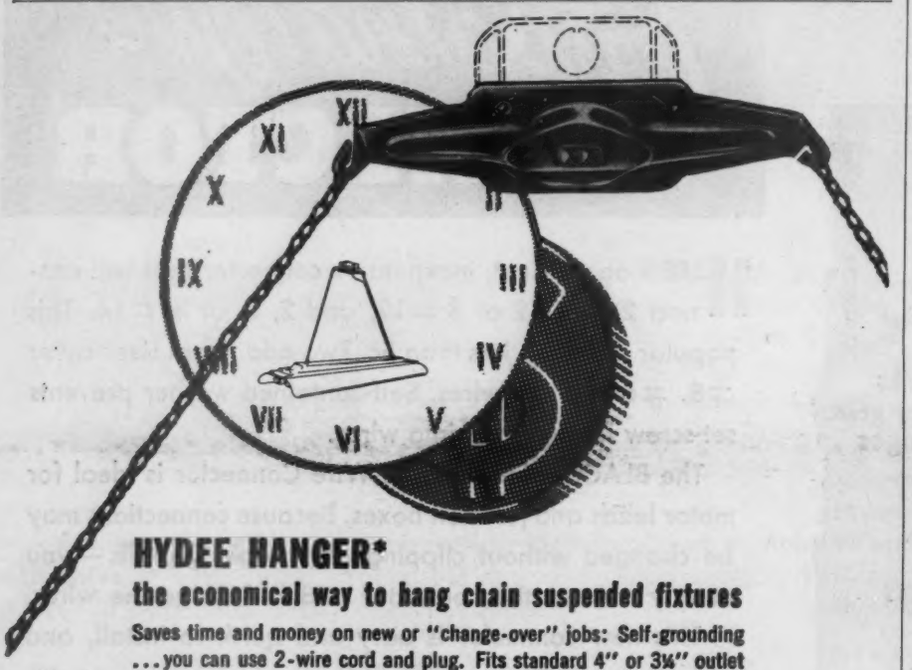
3600 powerful blows per minute from one working part — the piston — speed up the drilling of anchor bolt holes, cutting, chipping and channelling for conduit.

Operate from ordinary 110 volt AC lighting current.

They'll save you TIME and MONEY every job you use them. —And who isn't interested in that today?

Write for illustrated folder

SYNTRON CO., 690 Lexington, Homer City, Pa.



HYDEE HANGER*

the economical way to hang chain suspended fixtures

Saves time and money on new or "change-over" jobs: Self-grounding ...you can use 2-wire cord and plug. Fits standard 4" or 3¼" outlet box or plaster ring. **Complete** with receptacle, two 5-foot chains, spring wire "S" hooks and cord clips.

$1.65 LIST

Day-Brite Lighting, Inc., 5402 Bulwer Ave., St. Louis 7, Mo.
Nationally distributed through leading electrical supply houses.

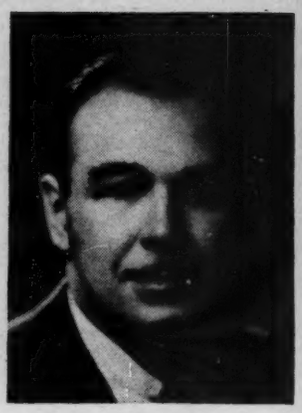
In Canada: address all inquiries to Amalgamated Electric Corp., Ltd., Toronto 6, Ontario.

012

IT'S EASY TO SEE WHEN IT'S **DAY-BRITE** *Lighting*

*Patent No. D-141084 and No. 440914 Underwriters approved.

H. H. WEBER



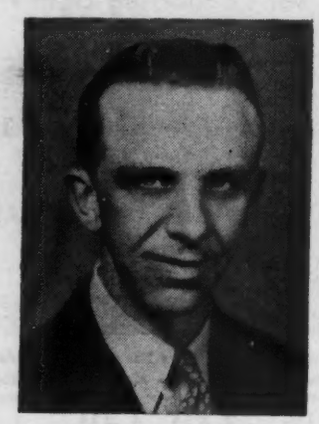
A. S. BASIL

ects; G. E. Hubrig, sales manager, western division; C. A. Bartron, chief sales engineer, A. E. Aune, manager, automotive and aircraft wire sales, and R. C. Cassidy, manager, Uskon sales.

R. W. HELMIG ELECTED VICE PRESIDENT

The Electric Products Company, Cleveland, Ohio, has announced the election of R. W. Helmig as a vice president and director.

Mr. Helmig joined the organization in December 1944. Previously he had



R. W. HELMIG

been connected with Delco Products Corporation, Commercial Investment Company, W. W. Sly Manufacturing Company and had owned the Planefilm Corporation.

Enclosed Switches TYPES "A" and "C"

These safety controls of the higher grades serve for a wide range of applications, — reliably in all. Each type embodies the finest materials and workmanship its price-class affords. Both types have quick make-and-break precision mechanism, unit base for each pole 60 Amps. and over. Complete range of knockouts, attractive machine-gray finish. Listed as standard by Underwriters' Laboratories, Inc.

TYPE "A" — Range 600 Volts and less; 30 to 1200 Amps. Horsepower rated. Fusible or no-fuse types, with Interlocking Cover (cannot be opened when switch is "ON".)

TYPE "C" — Range 600 Volts and less; 30 to 600 Amps. Horsepower rated. Fusible or no-fuse types. Cover non-interlocking with snap latch; may be fastened by padlock. Highly serviceable switch for average requirements; priced lower than TYPE "A".

Mail this Coupon

To Arrow-Hart & Hegeman Electric Company, Hartford 6, Conn.

Send us your new Catalog C-10 of Enclosed Switches — Types "A", "C" and "D" — and other Service Equipment.

(*Name*)_____

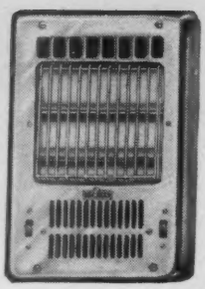
(*Company*)_____

(*Address*)_____

(*City & State*)_____

THE ARROW-HART & HEGEMAN ELECTRIC COMPANY, HARTFORD, CONN., U. S. A.

NEW FEATURES *mean* **NEW PROFITS** *for you!*



FAN-GLO HEETAIRES give you NEW potent selling features . . . THERMOSTATIC CONTROLS plus your customer's choice of ivory, brown or nuchrome finishes!

—THERMOSTATIC CONTROL—

Every FAN-GLO HEETAIRE available with Thermostatic Control. Automatic range from 56° to 84° F. Ivory enamel case—equipped with thermometer (Underwriters' Approved).

New recessed Heetaires (series 230 and 240) are available in special electrically baked ivory and brown enamels—in addition to Nuchrome—for living rooms, dining rooms, bedrooms, etc. That means more sales—more profits for you!

MORE PROFITS for you . . . because it's backed by powerful selling ammunition —a dynamic sales manual, sales literature, catalog and specification sheets and charts . . . plus national magazine and newspaper advertising that drives home to millions of prospective customers the fact that FAN-GLO HEETAIRE is the only heater that gives BOTH kinds of heat—Warm Comfort Quickly.

Call your jobber--he's all set to help you make more sales--more profits.

Tested and Listed Under Reexamination Service by Underwriters Laboratories, Inc.

MARKEL ELECTRIC PRODUCTS, INC.

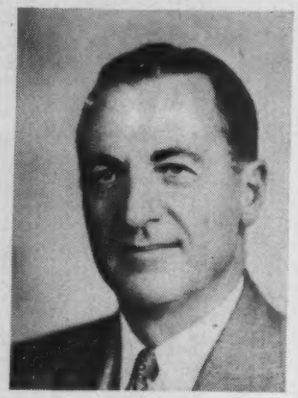
LA SALLE LIGHTING PRODUCTS INC.

147 SENECA ST. ● BUFFALO 3, N. Y.

J. A. BORDEN ELECTED VICE PRESIDENT

J. A. Borden was elected vice president in charge of the "Scotch" tape division of Minnesota Mining & Manufacturing Co., St. Paul.

He joined the firm in 1925 and for seven years has been sales manager

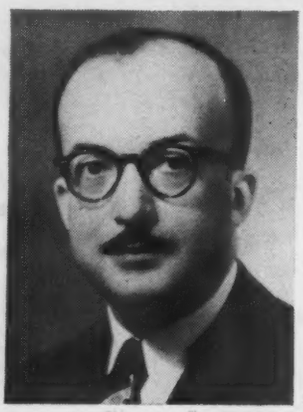


J. A. BORDEN

for "Scotch" tapes, including the transparent cellulose tape, 40 electrical tapes and others for packaging, masking, sealing, decorating and sand blasting.

M. J. GROSSE NAMED EXECUTIVE VICE PRESIDENT

Appointment of Milton J. Grosse to be executive vice president of the Verd-A-Ray and Penetray corporations has been announced. Mr. Grosse be-



M. J. GROSSE

came a vice president in charge of sales five years ago.

Clifford H. Chamberlain has been named national department store sales manager. He was formerly divisional sales manager.

GRAYBAR CHANGES

William Sully has been appointed district operating manager at Boston by Graybar Electric Co. He will be responsible for customer service and the operation of the office and warehouse at Boston and its branches located at Providence, Worcester, Springfield, Portland and Manchester.

B. P. Van Inwegen has been named assistant manager lighting sales. He will assist R. C. Kinney, national manager of lighting sales and will make his headquarters at 420 Lexington Avenue, New York City.

C. C. McGraw has been appointed manager at Knoxville, Tenn., replacing the late F. O. Andridge.

R. L. Wear has been named manager Savannah and A. W. Wheeler manager at Shreveport.

C. T. BUTTON NAMED VICE PRESIDENT

Howell Electric Motors Company, Howell, Mich., has announced the appointment of Charles T. Button as vice president in charge of sales. Thomas J. Manning, assistant to the president, was named a vice president.

Mr. Button was also elected to the board of directors, replacing Jack H. Hazelhurst of Adams and Company, Chicago, Ill.

●

At the annual stockholders meeting of the **Jefferson Electric Company,** Bellwood, Ill., J. M. Bennan, vice president and G. W. Ziegler, vice president in charge of production were elected members of the board of directors. W. A. Minter, formerly assistant secretary, was elected secretary; and V. E. Lee named assistant secretary.

●

The Weston Electrical Instrument Corporation of Newark, N. J. has announced the appointment of three new representatives to cover Texas and Oklahoma. This area was formerly served by the T. C. Ruhling Company of Dallas, who has retired.

The new representatives and their territories are: Butler and Land, 3405 Milton Avenue, Dallas will cover north Texas; Lynn Elliott Company, 322 M. & M. Building, Houston, will cover south Texas; and Riddle and Hubbell, 302 South Cheyenne Avenue, Tulsa, will cover all of Oklahoma.

●

The recent appointment of Max L. Stoughton as Philadelphia district sales manager has been announced by the **I-T-E Circuit Breaker Company** and its subsidiary, the Railway and Industrial Engineering Company.

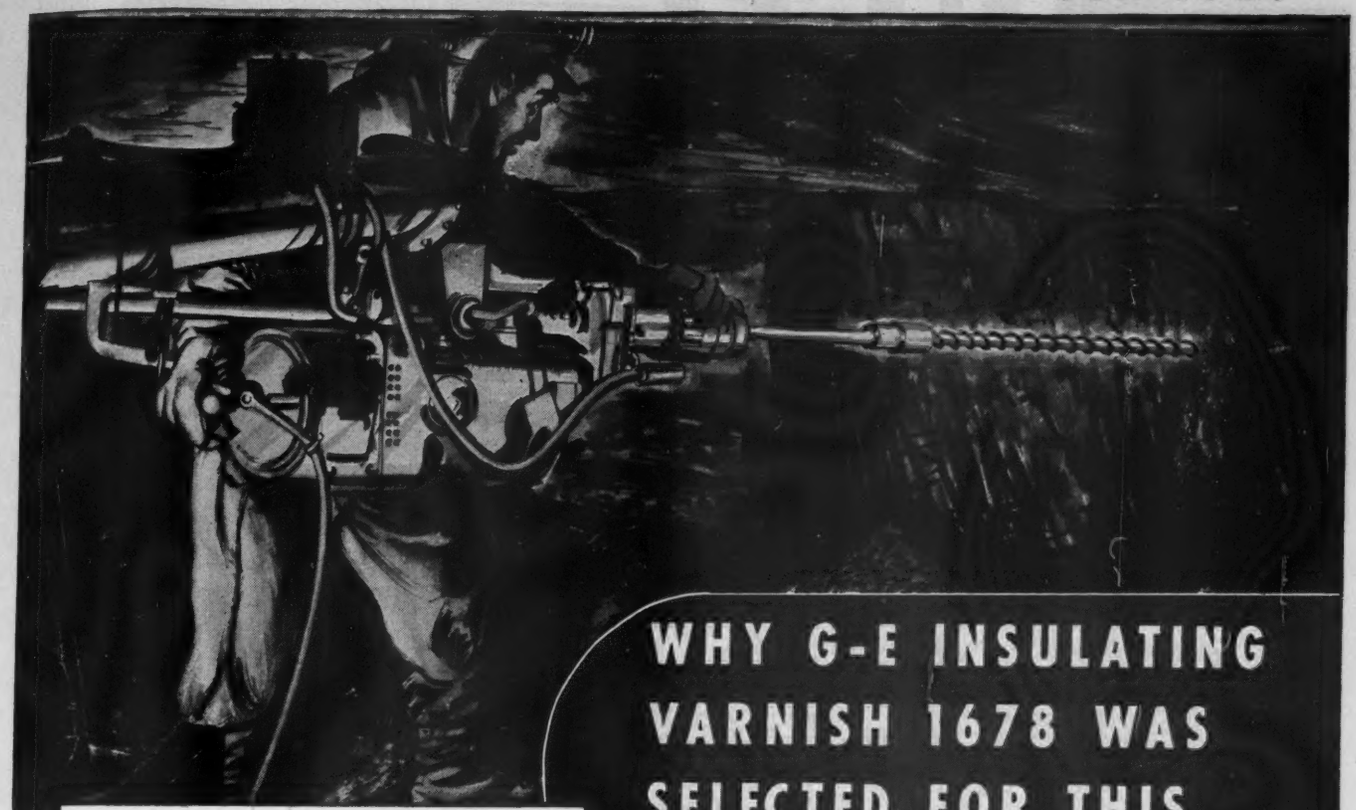
●

The Diamond Wire & Cable Co. is discontinuing its Chicago Heights plants and consolidating all operations in its plant at Sycamore, Ill.

●

Louis S. Danko has been named sales manager of the special products department of **Acme Electric Co.**

WHICH G-E INSULATING VARNISH FOR YOUR JOB?



WHY G-E INSULATING VARNISH 1678 WAS SELECTED FOR THIS COAL-MINE DRILL MOTOR

Here Are a Few of the Many G-E Varnishes Designed for Specific Types of Applications

	FOR MILL MOTORS	FOR FHP MOTORS	FOR MACHINE TOOL MOTORS	FOR POWER DISTRIBUTION APPLICATION
	G-E 9555	G-E 9535	G-E 1679	G-E 1673
BOND	GOOD	GOOD	GOOD	GOOD
DIELECTRIC STRENGTH	GOOD	EXCELLENT	EXCELLENT	GOOD
RESISTANCE TO MOISTURE	EXCELLENT	EXCELLENT	EXCELLENT	GOOD
RESISTANCE TO ALKALI	EXCELLENT	GOOD	GOOD	FAIR
RESISTANCE TO ACIDS	EXCELLENT	EXCELLENT	GOOD	GOOD
RESISTANCE TO SALT WATER	EXCELLENT	EXCELLENT	GOOD	GOOD
PENETRATION	EXCELLENT	EXCELLENT	GOOD	GOOD
TOUGHNESS	EXCELLENT	EXCELLENT	EXCELLENT	GOOD
HIGH TEMPERATURE AGING	GOOD	GOOD	GOOD	EXCELLENT
FLEXIBILITY	GOOD	GOOD	GOOD	EXCELLENT

Order . . .

● Dust and dampness are the enemies of mechanized equipment underground. That's why General Electric specialists recommend G-E Insulating Varnish 1678 to properly protect this coal-mine drill motor.

G-E Clear-Baking Varnish 1678 forms a hard tough skin that seals out moisture, salt water, oil, acid, and alkali. It combines exceptional heat and arc endurance with high dielectric strength.

Bring your insulation problems to General Electric. Let experts provide the one *right* varnish that will do your job. And count on famous G-E quality control methods to keep each shipment strictly uniform.

More information? Call your local General Electric Merchandise Distributor. Or write: Resin and Insulation Materials Division, Chemical Department, General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

CD48-S2

Electrical equipment is no better than its insulation

MULTI

Fluorescent Lamp Fixture for shop, mill, factory

Incandescent Steel Reflector Porcelain Enamel

Incandescent Vaporproof Fixture Dust and Moistureproof

INDUSTRIAL LIGHTING EQUIPMENT

Better Lighting Makes Better Business for User and Contractor . . . . . .

For modernization needs of all kinds the MULTI line is your best bet—every unit has a specific need and will give a maximum of service life with a minimum of maintenance. Indoor or outdoor—fluorescents or incandescents—general or localized—MULTI fills the bill. Better lighting installations make for better business and the contractor gets a good share of this profitable market when he uses MULTI units.

• Send for our complete catalog.

MULTI ELECTRICAL MANUFACTURING CO.
4223 W. Lake Street Chicago 24, Illinois

New LIGHTWEIGHT ELECTRIC PLANT

5000 WATTS D.C.

Weighs only 315 lbs.!

Model 5CK-115M, 5,000 watts, 115 volts D.C.

Use fast-working electrical tools on any construction or maintenance job with this high capacity, portable, compact electric plant. Equipped with four-receptacle box for direct plug-in of tools or lights. Available with carrying frame, or dolly-mounted. Powered by Onan 10 HP, two-cylinder, 4-cycle, air-cooled engine. Shipped complete . . . ready to go!

NEW ONAN "CK" ELECTRIC PLANTS are available in 5000 watts D.C., 115 and 230 volts; 2000 and 3000 watts A.C. in all standard voltages.
COMPLETE ELECTRIC PLANT LINE INCLUDES: A.C.—350 to 35,000 watts in all standard voltages and frequencies. D.C.—600 to 15,000 watts, 115 and 230 volts. Battery Chargers—500 to 6,000 watts, 6, 12, 24, 32 and 115 volts.
ONAN AIR-COOLED ENGINES—CK: 2-cylinder opposed, 10 HP. BH: 2-cylinder opposed, 5½ HP. IB: 1-cylinder, 3¼ HP.

Onan PRODUCTS

Write for catalog

D. W. ONAN & SONS INC.
2139 Royalston Ave., Minneapolis 5, Minn.

ONAN ELECTRIC PLANTS

The appointment of C. Porter Packard, Canton, Mass., as district manager of the Boston office territory of the **Crocker-Wheeler Electric Manufacturing Company** has been announced.

•

Littelfuse Incorporated, Chicago, announces the appointment of two new members to the board of directors. They are J. D. Hughes, recently appointed vice president in charge of sales for the company and E. F. Staub, legal counsel for Littlefuse.

•

Fred G. Kraut, 419 W. 54th St., New York City, has been named representative for the **Kirlin Company** of Detroit, Mich. Mr. Kraut will cover the New York City area as far north as Albany.

•

Johan C. Kromhout has been appointed manager of European sales for **Sylvania Electric Products, Inc.** He will make his headquarters at Sylvania Electric's International division offices, 50 Broadway.

•

Purchase of the manufacturing assets and patent interests of the **Nelson Stud Welding Corporation** of Lorain, Ohio and its associated companies, by the recently-formed **Morton-Gregory Corporation** of Michigan has been announced by Henry J. Morton of Detroit, president.

•

Square D Company of Detroit, Mich. has announced the appointment of J. L. Stanford as head of the switch and panel division, advertising section. He replaces G. La Piner who leaves Square D to join Evans Products Company.

•

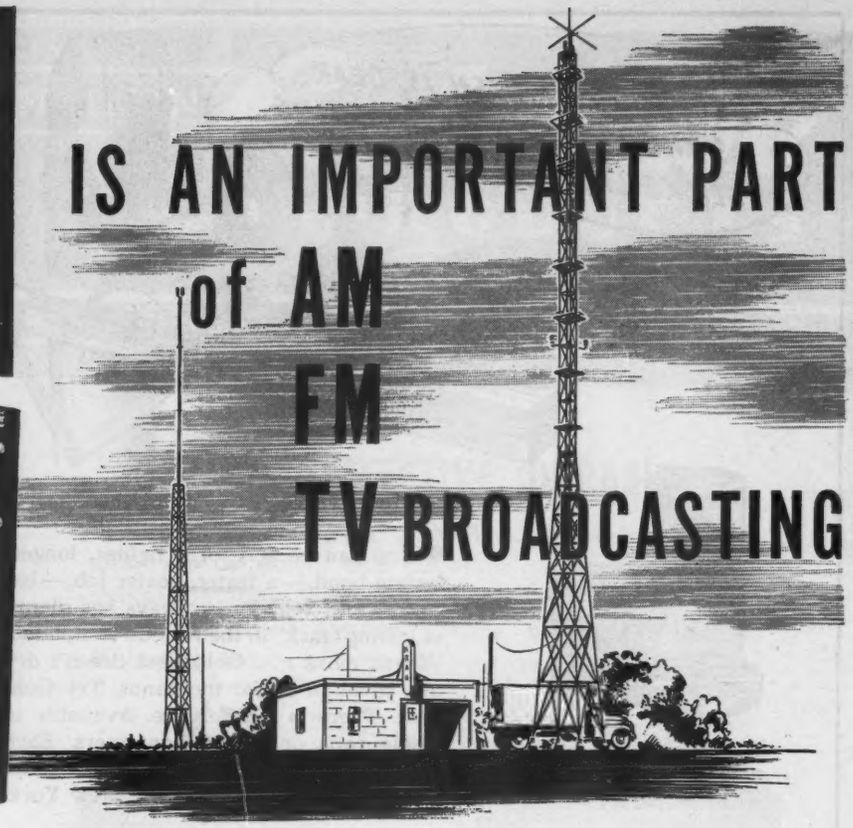
Lindberg Engineering Company, Chicago, has acquired the assets of the Electronics Division of **Illinois Tool Works.** John A. Callanan, who headed this division for Illinois Tool, will with his staff join the Lindberg organization.

•

Appointment of George R. Frankland as Chicago district manager, **Johns-Manville** Industrial products division has been announced. He succeeds Corydon H. Hall, who resigned to become president of a new company being organized in California.

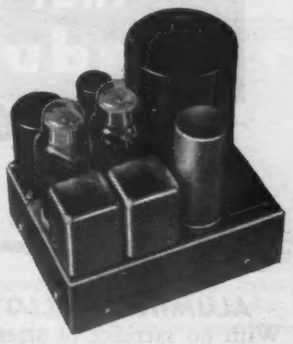
William S. Hough, formerly manager of the chemical and aviation sections of the company's special industries department at New York, will assume Mr. Frankland's former duties in Chicago as assistant district manager.

EM IS AN IMPORTANT PART of AM FM TV BROADCASTING



STABILINE Automatic Voltage Regulators Type EM (Electromechanical) are the answer to regulation problems in radio and television transmitting stations . . . high frequency relay stations.

The FCC recommends adequate voltage regulation equipment where the power supplied by the utility varies more than 3% from nominal over a 24 hour period. The STABILINE Voltage Regulator Type EM is ideally suited for this regulation task. Some of the outstanding features include . . . zero waveform distortion, complete insensitivity to the magnitude and power factor of the load, no effect on system power factor, high efficiency and no critical adjustments. Its long-term stability for 24 hour line correction means that Type EM requires negligible attention. Under normal conditions, the output voltage need not be adjusted more than once a month.



The STABILINE Voltage Regulator Type EM consists of an electronic detector circuit controlling a motor-driven POWERSTAT variable transformer. The moving parts are rugged, quality manufactured components which require a minimum of service and attention. The electronic control circuit itself is plug-in type and incorporates the latest advances in detector circuit design. This plug-in feature, combined with the convenient replacement service agreement made at the time of purchase, eliminates maintenance difficulties. The attractive black wrinkle-finished front panel has a 4 inch output voltmeter and screw driver adjustment controls for sensitivity and output voltage setting. Numerous models are available in ratings from 1 KVA to 100 KVA to meet most requirements. Rely on the experience of the Superior Electric Company's staff of voltage control engineers to assist with your voltage regulation problems.

Request Bulletin #448 for detailed information on the STABILINE Type EM and its application in the broadcast field.

Write The Superior Electric Co., 606 Meadow St., Bristol, Conn.

THE SUPERIOR ELECTRIC CO.
BRISTOL, CONNECTICUT

Powerstat Variable Transformers • Voltbox A C Power Supply • Stabiline Voltage Regulators.

Jenkins Bros. also make Diamond Seal Friction and Rubber Tapes which meet ASTM and Federal Specifications.

● You can be sure of a tighter, longer-lasting bond,—a faster, neater job,—because Gold Seal Tape always has plenty of lasting "tack" in the friction compound. What's more . . . Gold Seal doesn't dry out, ravel, or smear the hands. Try Gold Seal. There *is* a difference. Available in single rolls or 10-roll containers. Each roll cellophane wrapped. Jenkins Bros. (Rubber Div.), 80 White St., New York.

JENKINS Gold Seal Tapes
FRICTION-RUBBER

MADE BY JENKINS BROS . . . MAKERS OF FAMOUS JENKINS VALVES

DID YOU KNOW
that you can get
Conduit Fittings
like this?

ALUMINUM ALLOY—2/3 less weight
With no sacrifice of strength, Kondu fittings make a big cut in the weight of conduit lines or portable equipment.

Practically CORROSION PROOF
Many times more resistant to corrosion than other materials previously used for conduit fittings.

Your choice of THREADED or THREADLESS
Threaded Kondu fittings have covers and other accessories interchangeable with the Threadless line. USE THE RIGHT FITTING every time—there's a Kondu that's exactly suited.

KONDU CORPORATION, Erie, Penna.

KONDU MFG. CO. LTD., Preston, Ontario

The Wiremold Company, Hartford, Conn., announces the addition of three men to augment its sales staff. Thomas J. Pugh of Baltimore will assist Walter S. Beckett, district sales manager at Philadelphia, Charles J. Wirtz has been added to the Chicago staff under Ambrose J. Massey, and Robert J. Brazill will assist George W. Sundstrom in the Metropolitan New York area.

●

General Controls Co. has announced the promotion of Mel W. Lewis to branch manager of the Cleveland, Ohio factory branch office. Mr. Lewis has been associated with General Controls Co. in San Francisco for the past ten years.

●

The Adalet Manufacturing Co., Cleveland, has appointed Lewis P. Chick of Louisville, Ky. as factory representative in Indiana.

●

C. W. Coslow, vice president in charge of manufacturing of the Los Angeles plant, and M. M. Mautner, vice president and secretary, were elected directors of the **Plomb Tool Company** of Los Angeles.

●

The John C. Dolph Company of Newark, has appointed Walter E. Harvey as director-product development and research.

●

Carl E. Brock, Jr. has been appointed branch manager at the St. Louis office of the **Ilg Electric Ventilating Co.** He succeeds H. L. Branigin, who is retiring.

●

Tinnerman Products Inc., Cleveland has announced the appointment of William M. Buttriss to the position of director of advertising and sales promotion.

●

Mitchell Manufacturing Company of Chicago has named Armand S. Zucker as advertising and sales promotional manager.

●

The Frink Corporation of Long Island City, New York, has named H. M. Stacy as representative in the New England states.

●

The Chicago offices of **Allen-Bradley Company** is now located in new and larger quarters at 445-447 North LaSalle St.

NISA CONVENTION REPORT

[FROM PAGE 51]

a new method of checking output of alternating current windings, a particularly helpful scheme when motor nameplates have been lost. Maximum torque (the most important characteristic of a motor) is checked by taking a *No-Rotor Ampere* reading of the stator (rotor removed). Such a reading, Davies asserted, will tell in any single or polyphase motor up to 10 hp. (except series motors) very close to what the maximum torque of the motor will be; will reveal the approximate horsepower and proper operating voltage. Comparison of this reading with a locked-rotor ampere reading will give an approximation of starting torque and a check on rotor troubles, he added.

Non-Technical Shop Problems—C. R. Durand, Allentown, Pa., was chairman of this session dealing with such shop problems as handling, pricing special jobs, tagging systems and employee training.

Equipment handling problems can be effectively reduced by intelligent use of modern material handling methods. A large number of shops are in need of such equipment, stated Arthur Wagner, Sr., Arthur Wagner Co., Chicago. The use of platform winches, beam cranes, hydraulic trucks, gantry and jib cranes and other units were outlined.

Overall shop efficiency can be increased by the use of a good tagging system for work going through the shop, stated Joseph Heller, Consolidated Electric Motor Co., New York City. Mr. Heller uses a three-section perforated job ticket (shop, office and customer sections) that contains all necessary data and a description of work to be done. All correspondence, receipts and data carry a shop number.

There is no cut and dried formula

H. W. Pedersen, Industrial Electric Equipment Co., Davenport, Iowa; Paul G. Winter, American Electric Co., Indianapolis, Ind.; Carl W. Reifeis, Moran Electric Service, Indianapolis.

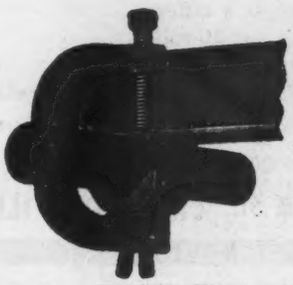
FULLMAN Latrobe PRODUCTS

FLOOR BOXES ★ WIRING SPECIALTIES

FULLMAN MANUFACTURING CO. QUALITY AT LATROBE SUPREMACY LATROBE, PA.

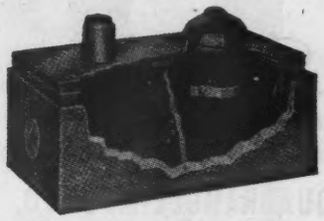
SIMPLE, EFFECTIVE, DURABLE

"Latrobe" Floor Boxes and Wiring Specialties are simply constructed, and therefore quick and easy to install. Imaginatively yet practically designed, they render excellent service. Made of highest grade materials, they are both efficient and lasting



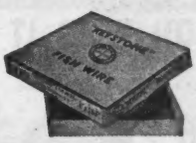
No. 470 "Latrobe" Pipe or Conduit Hanger

High quality and sure performer yet very economical for hanging pipe or conduit to steel beams. Takes pipe ½", ¾" and 1".



No. 252-R Floor Box

Two-gang Floor Box with No. 208 Receptacle in one section. One Cover Plate with ½", the other with 2" Flush Brass Plugs.



"Keystone" Fish Wire

High quality flat steel wire. Ten sizes, in coils from 100 feet up.

No. 110 "Latrobe" Watertight Floor Box

Approved by Underwriters Laboratory. Iron box body. 3½" round brass cover plate. No. 208 fits tapered opening in top of box body.

"Bull Dog" Insulator Supports

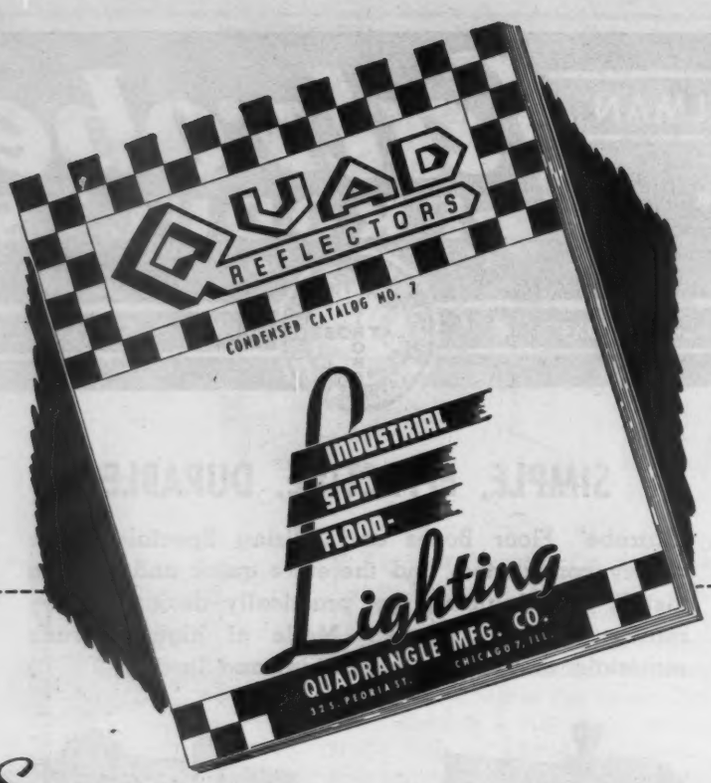
Malleable iron of high tensile strength for fastening porcelain or glass insulators to exposed steel frame-work. Four sizes.

Sold Only Through Wholesalers

"Bull Dog" BX Cable Staples

These high quality staples are available in any quantity. Packed in cartons, kegs and barrels.

FULLMAN MANUFACTURING CO.
LATROBE . . . PENNSYLVANIA



SEND for Condensed Catalog No. 7. Keep it handy and refer to it for correctly designed units for good modern installations. It's a sales aid whether for industrial—sign or flood lighting.

QUADRANGLE MFG. CO. 32 S. PEORIA ST. CHICAGO 7, ILL.

ELECTRICITY

WHERE YOU NEED IT . . . WHEN YOU NEED IT
with a

Universal "MATCHED UNIT" **ELECTRIC PLANT**

For dependable electric power—anywhere, any time—choose a Universal. In this most complete line are models—AC or DC, air-cooled or water-cooled engine powered, portable, standby or stationary—for any purpose. Sizes from 250 to 25,000 watts with all types of controls—manual to fully automatic.

Universal Electric Plants are of "Matched Unit" construction—with generator, engine, etc., matched exactly to the other. This assures smooth, low-cost, long-time service.

SEND FOR FOLDER. "ELECTRICITY AT LOW COST!" Gives Full Story of Universal Design—Shows 16 Different Models.

Contractors and Representatives. Write for details on the profitable Universal franchise.

Universal 2,000-watt Models — for lighting, powering tools, radio, etc. One-cylinder, air-cooled engine.

Universal 6,000-watt Series — for medium power requirements. Four-cylinder water-cooled engine. Other models, one to six cylinders, 250 to 25,000 KW.

UNIVERSAL MOTOR COMPANY
FOUNDED 1898
438 UNIVERSAL DRIVE · OSHKOSH, WISCONSIN

E. F. Kehne and H. E. Slack, Bussmann Mfg. Co., St. Louis; Ivan Pixler, Pixler Electric Co., Spencer, Iowa.

for pricing special jobs that come to the electrical repair shop. The only way to assure a satisfactory profit on such work is to keep accurate cost records on similar jobs previously done, said J. Arthur Turner, Tampa Armature Works, Inc., Tampa, Florida. Mr. Turner maintains an accurate cost accounting system plus permanent records of labor, material and other costs on large, special rewind jobs done in his shop. Reference to these permits accurate bidding on similar work in the future, he stated, citing numerous examples to illustrate his contention.

Despite improvements in a-c variable speed motors, the ideal design has yet to be made, declared S. B. Gaylord, General Electric Company. Industrial requirements vary, he added, citing a McGraw-Hill survey that showed the following: Of all users of variable speed drives, 27 percent require a 3 to

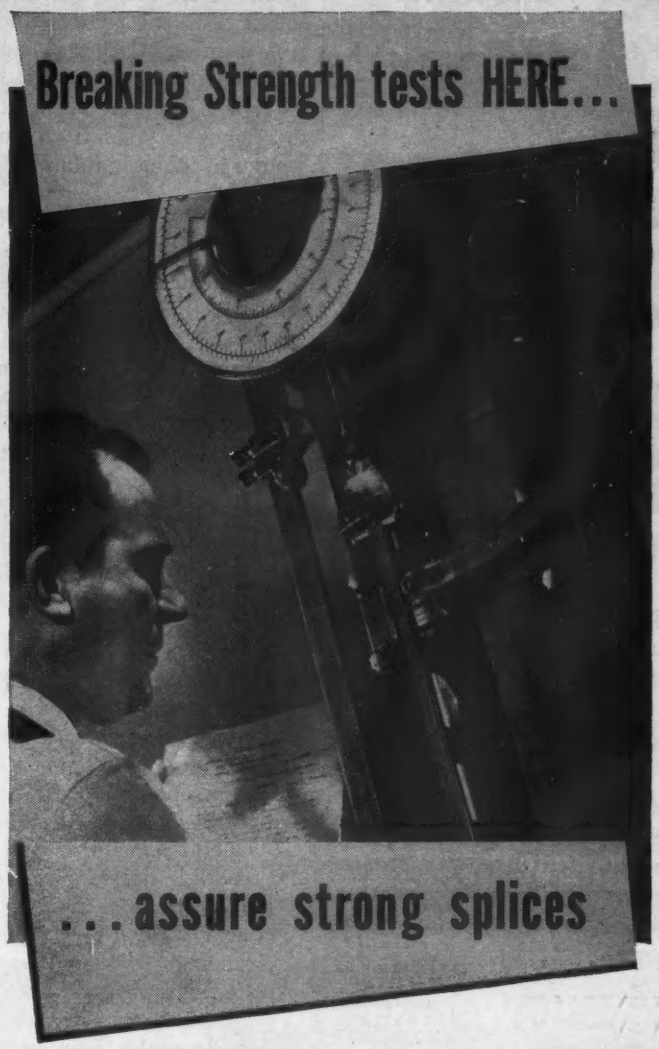
N. R. "Bud" Norman, engineer, Superior Mfg. Co., Cleveland, Ohio; C. V. Epting and C. A. Andrews, Jones Electric Repair Company, Charlotte, N. C.

Carbon brush problems are aired at NISA convention exhibit by (L to R) J. D. Watson, chief electrician, strip sheet dept., Jones & Laughlin Steel Corp., Pittsburgh, Pa.; F. G. Vance, Barnes & Tolley Engineering Co., Clarksburg, W. Va.; and Charles W. Adams, chief engineer, Ohio Carbon Co., Cleveland.

1 range; 44 percent from 3:1 to 10:1; 14 percent 10:1 to 20:1; 15 percent 20:1 and higher. Thy-mo-trol, an electronic drive that meets all speed group requirements was discussed by E. H. Alexander of the same company. C. G. Grant told the motor shop men about GE's new ACA motor line—an all-electric variable speed drive for a-c systems.

The H. N. Crowder, Jr., Company, Allentown, Pa., is cooperating with the local high school electrical department in a Student Trainee Program designed to help the student decide if he would like to enter the electrical equipment repair field. Under the plan, outlined by C. R. Durand, one student per week spends five days in the Crowder organization observing and following operations in the office, shop, branch house, on sales calls, construction projects and trouble calls. Each day the student makes a dictaphone report of his activities and the benefits he has derived. At the end of the week he receives his pay check and his trainer's report rating him on "incentive and interest". The school faculty analyze these reports and return comments to the Crowder office which bears the full cost of the plan as its contribution to vocational guidance. To date about 24 students have been in the program. Out of it Crowder hopes to get some first class students interested in the electrical repair business.

A report of the NISA Research Division reveals that Section 1 of the Rewind Data Book is now available at no cost to NISA members. This covers polyphase rewind data of the various

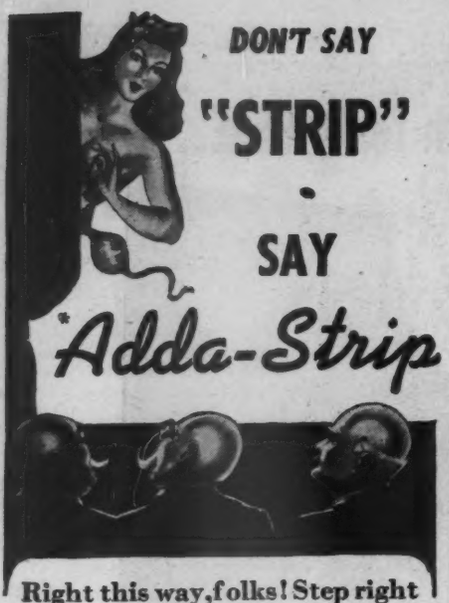


● The exceptionally high tensile strength of the fabric used in PANTHER and DRAGON Friction Tapes makes for stronger splices . . . splices that last longer. This higher quality is guaranteed by constant checks on breaking strength, such as the one for ASTM specifications shown above.

PANTHER and DRAGON Friction Tapes also rate high in tests for adhesive and electrical properties . . . work easily and stay spliced in cold as well as warm weather. Sold only through recognized independent wholesalers. The Okonite Company, Passaic, New Jersey.

6410

Panther and Dragon
friction and rubber tapes

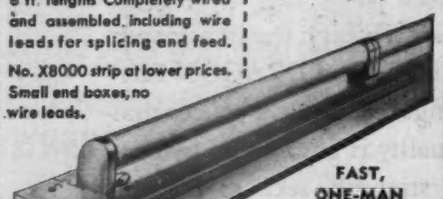


Right this way, folks! Step right up and meet Addie, the "Adda-Strip" girl. Look for her at leading wholesalers. And remember don't say "strip", say "Adda-Strip". It's the password that saves you money in the long run ... and the longer the run the bigger the saving. 18 inches or 18 miles, Adda-Strip's unique construction features and superlative, precision-built quality add up to quick, inexpensive installations.

*ADDA-STRIP T. M. REG. U. S. NO. 394,728 U. S. PATENT NO. 2,434,781

No. 8000 Adda-Strip, 18" to 8 ft. lengths Completely wired and assembled, including wire leads for splicing and feed.

No. X8000 strip at lower prices. Small end boxes, no wire leads.



FAST, ONE-MAN INSTALLATION

- Wired complete with ballasts, starters, sockets and lead wires.
- Covers snap on—hold without screws.
- Embossed screw-holes automatically line up ends and couplings.
- 8 ft. units save handling and splicing on continuous runs.

Adda-Strip is the most complete line, including single and double row for fluorescent or slimline and vest pocket strip for confined areas. Accessories include reflectors, hinged louver shields, louver and plastic shielding combinations.

GARCY America's leading manufacturer of strip lighting

GARDEN CITY PLATING & MFG. CO.
1750 North Ashland Avenue
CHICAGO 22, ILLINOIS

1898 - 50 YEARS OF LEADERSHIP - 1948

speeds of 15 leading makes of motors. When sufficient records are available from members, larger ratings (15 hp. and above) will be covered in Section 2. NISA engineer D. W. Rust hopes to complete Section 3 on single phase motors in the near future.

NISA Award Winners

This year's NISA Award Contest drew 44 entries from 28 contestants in 30 shops throughout the county. Entries were judged on the basis of originality, practicability, design, cost of fabrication and universal application in all shops large or small. Winners announced by Award Committee chairman Fred S. Ferris were:

First Award ($100)—Albert C. Hanson, The Sullivan Electric Co., Cincinnati, Ohio. Design of simple pry-bars for straightening stator laminations.

Second Award ($75)—Erik Gyllenberg, Electrical Installation Co., Cambridge, Mass. Use of a conventional growler to heat up ball bearings and commutators prior to installation on shafts.

Third Award ($50)—Wm. S. Giles, Giles Armature and Electric Works, Inc., Marion, Ill. Design of a tension device.

Fourth Award ($25)—Richard Feldman, Willey-Wray Electric Co., Cincinnati, Ohio. Design of a small armature stand.

Ten honorable mention awards of five dollars each went to the following: Wm. C. Bedoit, Chattanooga Armature Works, Chattanooga, Tenn.; Richard E. Feldman, Willey-Wray Electric

Discussing insulations at the recent NISA Convention Exhibit in Pittsburgh are: (L to R) G. H. Treat, Owens-Corning Fiberglas Corp., Toledo, Ohio; C. H. McCullough, McCullough Electric Co., Pittsburgh; F. Acker Thompson and S. J. Taylor, representing The Russell Manufacturing Co., Middletown, Connecticut.

"A fixture for every outdoor purpose"

Ornamental OUTDOOR LIGHTING FIXTURE

CAST IRON
BRONZE
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ALUMINUM

We are in our 40th year of manufacturing outdoor fixtures suitable for all classes of buildings.

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We also make special fixtures for Churches.

Victorian Carriage Lantern No. 400 is shown—we also have this same fixture—No. 401 with square cage.

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1756 Sedgwick St., Chicago 14, Ill.

It's a Fact!
ILSCO LUGS
ARE
10% to 20%
COOLER
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WRITE FOR SAMPLES and the Ilsco 54-page illustrated catalog.

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CINCINNATI, O.

Easterners at the NISA Convention in Pittsburgh included: (L to R) W. N. Parkes, T. H. Green Electric Co., Inc., Rochester, N. Y.; S. N. Buchanan, Buchanan Electric Products, Elizabeth, N. J.; Roy S. Bowser, M. H. Salmon Electric Co., Syracuse, N. Y.; and Ray F. Hornbeck, of the T. H. Green Company in Rochester.

Co., Cincinnati, Ohio; Erik Gyllenberg, Electrical Installation Co., Cambridge, Mass.; John Havranek, Central Electric Co., Cambridge, Mass.; H. B. Jeffares, Tennessee Electric Motor Service, Knoxville, Tenn.; W. E. Laycock, Laycock Armature Works, Tampa, Florida; L. R. Probert, Zack Brothers Electric Co., Mason City, Iowa; Cleveland Sampson, Stultz Electric Works, Westbrook, Maine; Adolph Schwindt, Buzzell Electric Works, San Francisco, Calif.; LeRoy E. Whitaker, Electrical Installation Co., Cambridge, Mass.

Business Session

A membership committee report revealed that eleven new NISA Chapters were chartered during the past year bringing in 132 new active and 12 associate members. As of April 1, 1948, the total membership stood at 822 active and 46 associate. About 15 members have been added since that time.

Concern of some members over the active solicitation of repair business by motor manufacturers (including makes other than their own) was revealed in a Trade Relations Committee Report.

According to the Sales Survey Committee report, shops have experienced a decrease in labor and overhead cost and an increase in materials cost during the past year. Raw labor was 23 percent of sales in 1947 compared to 31 percent a year ago. Other figures in percent of sales in 1947 compared to 1946 were: Operating overhead, 7.1 against 7.5; operating expense, 4.5 against 1.0; housing overhead, 2.1

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40° to any desired angle

60° without moving pipe

90° in one operation

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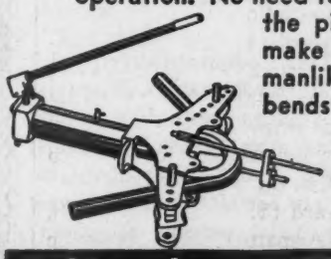

Bus Bar Bending Attachment — for 3" bender. Bends up to 4" bus bar.

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FAM EMT Thin Wall Conduit Fittings

Steel

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FAM Coupling (Cutaway View)

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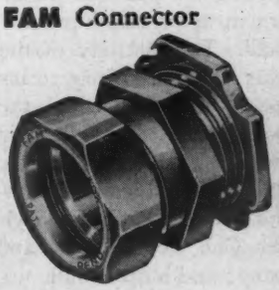

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Channellock Pliers are specifically designed for:

Battery Work — Ignition Work
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MEADVILLE • PA.

Only Champion DeArment makes
CHANNELLOCK

Shop problems are aired in lobby session at NISA Pittsburgh convention by Fred W. Keimle (left), The Fred W. Keimle Co., Toledo, Ohio; and Edw. J. Daughn, Globe Electric Repair, Sharpsburgh, Pa.

against 1.5; administrative, 11.6 against 11:5; transportation, 21 against 1.9; profits before taxes, 10.9 against 10.5; profits after taxes, 8.1 against 9.2 in 1946. Shops doing a volume of $100,000 to $200,000 had the lowest labor cost (21.1 percent of sales); those doing up to $50,000 the highest (29.2 percent).

Several minor revisions in the constitution and by-laws to eliminate inconsistencies resulting from association growth were approved by the convention. The maximum limit on directors has been advanced to 20; the number of associate members will be limited to 10 percent of the active membership (formerly 15 percent). Responsibility for the operation of the association is virtually on the shoulders of the directors elected from the 15 regions throughout the country.

NISA's official family for the coming year includes the following: President—William S. Giles, Marion, Ill.; vice-president—Fred S. Ferris, Boston, Mass.; secretary—M. F. Zack, Mason City, Iowa; treasurer—H. E. Grant, Nashville, Tenn.; executive secretary—Fred B. Wipperman, St. Louis; NISA engineer—D. Ward Rust, St. Louis.

Between sessions and in the evenings shop men visited the exhibits of 29 manufacturers in areas adjoining the convention hall. The last day of the convention was devoted entirely to inspection trips. Delegates visited the service shops of the General Electric Co., Westinghouse Electric Corp; Braunlich-Roessle Co.; Electric Manufacturing and Repair Co.; Pennsylvania Electric Coil Co.; Stimple and Ward Company; and a steel mill.

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MORE SATISFIED USERS

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Nalco Infra-Red Lamps are available in a variety of styles, either inside silvered (self - reflecting), or clear glass type (for use with reflectors)

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All Sherman Lugs are individually inspected before shipment to maintain accurate dimensions and eliminate flaws affecting service qualities.

H. B. SHERMAN
Manufacturing Co.
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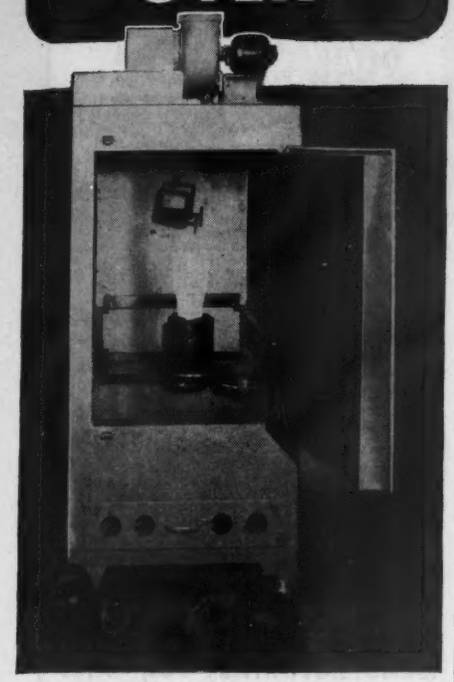
Sherman
SOLDERING LUGS

Despatch RS-O
"BURN-OFF" OVEN



Burns Off Insulation and Wedges in 15 or 30 Minutes Preparatory to Repair Work on Armatures • Stators • Coils

The Despatch RS-O "BURN-OFF" OVEN provides a fast, safe, and thorough method of removing all insulation and tape from motor windings. By use of a raw (yellow) gas flame, it completely chars (oxidizes) all the insulating material, tape and wedges so that motor parts can be quickly rewound. This low temperature "burn-off" method leaves the motor, stator or coil in clean condition for repair work, with no danger of warping frame. Time saving per job up to 70% on stripping.

SAFETY CONTROL—Shuts off main gas valve in case of pilot light failure, continuous exhaust fan purges oven interior of smoke, volatile and soot accumulated during burn-off process. Flame controlled by time clock for intermittent or continuous operation preventing overheating of parts being processed. The Despatch RS-O "BURN-OFF" OVEN is well insulated, keeps room cool, and has a clean-out drawer for easy removal of burned off material. Ask your dealer or write us for literature.

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WIRING FOR CANDY MAKING

[FROM PAGE 64]

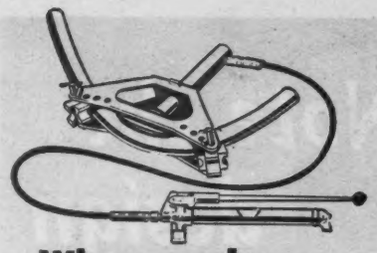
each ingredient can be maintained at the most desirable temperature.

Purity is another electrical concern, for, in addition to filtered air and thermostatically-regulated temperatures, electrical germicidal units are installed in the Frst Aid room, wash rooms and kitchen to destroy air-borne bacteria. Motor-driven washing machines and electrical driers and ironing equipment launder and finish the white uniforms of studio workers. Germicidal units also insure sterile seats in the toilets. To insure the exclusion of vermin, all electrical conduits were delivered to the job sealed, and service feeders are also sealed at the building line entrances.

The plant, kept immaculate by frequent washing and polishing, is also well lighted. In addition to large window areas, planned lighting maintains high level illumination in all areas. With the exception of incandescent installations in explosion-proof locations and some refrigeration space, lighting is fluorescent. In offices, units are recessed into acoustical ceilings and are shielded by spread lenses. In manufacturing areas, fixtures are open industrial types, pendant mounted, with lamps held securely in sockets by means of specially-designed clips.

Horizontal and vertical transportation is accomplished by motor-driven conveyors, elevators, dumb waiters, monorail systems and cranes. In addition to transportation between floors and between specific areas, many machines include integrated equipment for moving confections from one operation to another. Enrobing machines, with endless chain and gear arrangements, carry candy centers along a production line to points where they are bottom-dipped and top-coated with chocolate.

Varied as the electrical requirements for the normal candy studio are (office, manufacturing, kitchens, etc.) they are increased in the new Fanny Farmer plant due to the inclusion of machine and carpentry shops, garages and laundry space. Serving 70 neighborhood retail stores in the New York metropolitan area, the plant creates all window and counter decorations for these outlets, services their own fleet of delivery trucks, and launders uniforms and the old fashioned white ruffled curtains that have been familiar trade marks in all Fanny Farmer shops for over a quarter of a century.



When you buy a
BENDER
..check to make sure you get these features:

EASY TO GET TO THE JOB

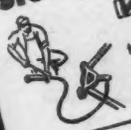
☑ Lightweight, portable—one man can easily take a Blackhawk Pipe Bender right to the job. Bends rigid conduit and pipe in all popular sizes, up to 4" dia.

WORKS AT ALL ANGLES

☑ The compact hydraulic Porto-Power Ram is all-directional. Power eliminates need for heating the pipe.

WORK OVERHEAD

☑ All-directional operation and light weight enlarges range of utility to use on ladders, scaffolds and cramped quarters and work on existing pipe runs.

SIGHT FROM ANY ANGLE

☑ Remote control permits operator to stand in any position for a full view of the job. Saves need for elbows, couplings, cutting and extra threading.

DETACHABLE POWER UNIT FOR EXTRA UTILITY

☑ It pulls gears, lifts machinery, and licks scores of other trouble jobs.

BLACKHAWK Porto-Power PIPE BENDERS

BLACKHAWK MFG. CO.
Dept. P2068, Milwaukee 1, Wis.
Mail Hydraulic Equipment catalog to:

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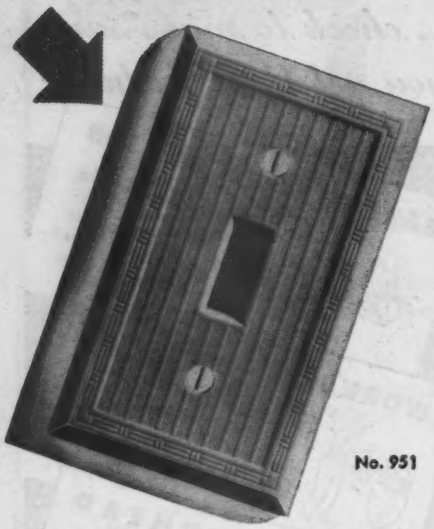
Note the design



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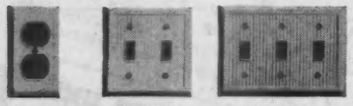
Extra heavy Bakelite
FLUSH PLATES
FOR TOP QUALITY JOBS

Pressed heavy Bakelite in this widely popular design combines beauty with rugged strength.



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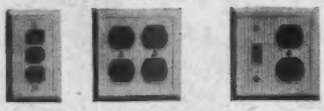

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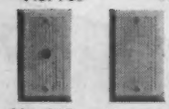

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Each plate packaged in an individual envelope complete with METAL screws.

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SCHOOL SIGNAL SYSTEMS

[FROM PAGE 59]

tensions of the master telephones may be provided in the principal's office consisting of a handphone on cradle with a pushbutton block. In large high schools and colleges a manual switchboard system or an automatic telephone system may be provided. In the former the operator would have full control of the traffic between all points. With the automatic type each person using the system may dial to secure another station.

A typical wiring diagram for clocks, program and telephone systems is shown in Figure 3.

Lecture call systems are in reality return-call systems and are used between the stage in the auditorium and the projection booth. Most of these systems consist of a station on the stage, installed in the wall or in the floor. A long portable cord with a detachable plug and a pushbutton is used for calling and a buzzer is used as a return signal. In the projection booth the signal station would consist of a flush pushbutton and a buzzer. Such a system enables the lecturer on the stage to signal the operator in the projection booth when a change in a slide is to be made or when a moving picture is to start. Telephones may also be combined in these systems.

Orchestra call systems are usually return call systems in which lamp annunciators with buzzer and switch are used and these are located in the orchestra pit. Outlying stations consist of buttons and buzzers and are located at the stage lighting switchboard and in the projection booth.

Dressing room call systems are similar to the return call systems mentioned previously. The annunciator is generally located at the stage lighting switchboard and the return call stations are located in each dressing room.

Fire alarm systems for use in schools are usually of four types. In small schools, either the closed-circuit non-code or master types are frequently used. In the first system non-code break-glass stations operate vibrating bells or horns continuously. In the second system non-code break-glass stations operate an electrically tripped master movement on the control panel which in turn operates either vibrating or single-stroke bells, or horns. A distinctive common coded signal is transmitted to the bells for a total of four rounds. In medium sized and large schools and colleges, the coded type of systems are used wherein every station

SIMPLICITY PLUS!

New NON-INDUCTIVE CABLE RACK

for INDUSTRIAL PLANT WIRING

Type D-F 3-Conductor Cable Rack, New Non-Inductive Design. Racks available for cable sizes from 5/16 to 2⅞"

● Radically different, the new M. & W. Non-Inductive Cable Rack is designed for A.C. or D.C. systems. Racked Cables only partially surrounded by metal eliminates any chance of induced current in the rack. Impedance reduced with cables mounted in delta formation. Rack of one-piece construction . . . installation of cables made quick and easy through the use of split bushing.

Send today for Bulletin C-S-51 which illustrates the complete line

THE M. & W. ELECTRIC MANUFACTURING CO., INC.
EAST PALESTINE, OHIO

A REALLY USEFUL SERVICE INSTRUMENT!

4 METERS IN 1

NEW MODEL B-6 MEGOHMER

❶ Insulation Tester, 0-200 megohms, 500 volts DC test potential. With exclusive triple-color grading scale.
❷ Ohmmeter, 0-2000 ohms.
❸ AC Voltmeter, 0-150/600 volts.
❹ DC Voltmeter, 0-150/300 volts.

Full details in Bulletin 441

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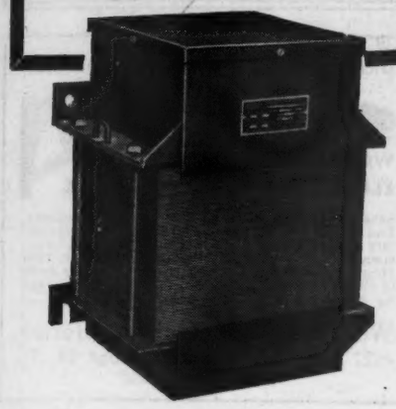
AIR COOLED POWER TRANSFORMERS



Heavy duty design, provides high efficiency performance at normal temperature rise of 55°C. All steel construction results in more KVA capacity per pound. Acme Electric air cooled transformers are built in sizes from 1/10 KVA to 50 KVA, primary voltages up to 600 volts.

Use Acme Electric Air Cooled Transformers to

- ☐ Operate 115 volt equipment from power circuit
- ☐ Distribute power at high voltage
- ☐ Eliminate double wiring
- ☐ Provide 3 wire circuits
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- ☐ Balance voltage

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Acme Electric
TRANSFORMERS

transmits its own distinctive code to the sounding devices. Where a number of buildings are involved the coded type systems may be modified and extended to a group system, wherein a fire in one building need not disturb students in other buildings. The operation therefore in one building operates all signals therein and in addition will only operate at certain other locations where supervisors and "bucket brigades" take command. Auxiliarized systems wherein the signal is also transmitted to the fire department may also be provided. This type of station is provided with two doors. When the glass is broken, the lever is exposed, and when pulled the alarm operates in the building and is also sent to the Municipal system. However, when a key is inserted in the lock of the station, it opens a second door which exposes a second operating lever which is used for fire drill purposes and only operates the bells in the building. Every precaution is taken in this station to prevent a false alarm from being transmitted to the Municipal system.

Sprinkler alarm systems are used in some areas in the school buildings where the fire hazard is considered great, such as in storerooms.

Tank alarm systems may be combined with the isolated sprinkler alarm panels or be connected to a separate control panel. Such a system consists chiefly of a float switch installed in the water tank and is arranged to transmit a signal when the water reaches a predetermined height or depth.

Systems used directly by the students are few and as a rule only in cases where they assist the administrators and teachers. However, there are some systems used for instructional purposes. Small telephone switchboards with a few outlying telephones are used in commercial high schools. A variety of signal systems are used in vocational schools for instructional purposes but these are usually purchased after the schools have been completed and are considered in the equipment budget. However, laboratory panels are used to a large degree in high schools and colleges. This equipment usually consists of a central control and distribution panel composed of meters and control switches to charge batteries, and plug and cord sets and receptacles to permit a-c and d-c to be supplied to the instructors table and the work benches throughout the laboratories. The work benches are supplied with receptacles and cord units for connecting to the current source and for connection to the various devices being tested and under study.

POWDER OPERATED CONSTRUCTION TOOL

Drives Threaded Studs 3 Inches Into Concrete *Instantly!*

Several of the more than 30 studs available with DRIVE-IT.
STUD HOLDING POWER BETWEEN 2000 and 6000 LBS.
.38 Cal. (top)
.22 Cal. (bottom)

Thousands of DRIVE-IT Powder Power Tools are now in constant use from coast to coast.

3000 PERCENT FASTER

DRIVE-IT does in seconds what used to require hours. Eliminates drilling, hammering, compressors, electricity, cords, expansion bolts. Anchors anything to concrete, masonry or steel in a split second.

HOW IT WORKS

DRIVE-IT derives its power up to 25 tons from a small powder charge encased in a standard .38 or .22 cal. cartridge. The desired anchor stud and cartridge are placed in the tool. The DRIVE-IT muzzle is forced vigorously against the work and at the same time the safety catch is released. This detonates the charge, and drives the stud with pile-driver force into steel or concrete. DRIVE-IT studs in ordinary concrete will hold the weight of the heaviest automobile.

ABSOLUTELY SAFE

DRIVE-IT is the orginal powder-operated tool. It functions without recoil shock . . . is as safe as an ordinary carpenter's hammer.

UNLIMITED APPLICATION

Thousands of contractors, sub-contractors, and maintenance departments use DRIVE-IT tools to anchor wood sleepers to concrete; to "bolt" machinery; to hang metal lath, pipe, switch boxes, etc. See DRIVE-IT for yourself. Write for name and address of your nearest distributor, and full information.

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What Do You Look For In LIGHTING EQUIPMENT?

If it's time proved features your customers insist on — if PERFORMANCE is emphasized — if attractiveness of design is demanded — REVERE lighting units offer ALL —Plus Ease of Wiring and Maintaining! BEST in SERVICE STATION— AIRPORT — SPORTS — INDUSTRIAL and MARINE LIGHTING

Floods up to 5000 Watt

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NEW *LOW PRICES*

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SUDDEN DEPTH CARBOLOY TIPPED DRILL BITS

Round Shank sizes from 3/16" through ¾"

NEW FLUTED DRILLS

Now added to our line of "Sudden Depth" Drill Bits, sizes from ⅜" through 1½"

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PAINE
FASTENING and HANGING DEVICES

2961 CARROLL AVE. CHICAGO 12, ILL.

CHECKING A-C STATOR OUTPUT

[FROM PAGE 53]

will give an approximate idea of the starting torque of a motor. It does this by determining the approximate rotor resistance. The lower the rotor resistance, the more current it will take stalled. The higher the rotor resistance, the less current it will take stalled. Generally, the higher the rotor resistance the better the starting torque.

Let us consider a typical 2-hp., 3-phase, 220-volt motor, full-load about 6 amperes. With a *No-Rotor* amperes of 36, this motor will have a maximum torque of close to 200 percent. If the stalled or locked-rotor amps., also taken on one phase only, is up around 33 to 34 amperes, we can consider this to be a low-resistance, low-slip rotor, and the starting torque will be very low, probably from 50 to 60 percent of full-load torque. Another rotor in the same stator, having a little higher resistance, has a locked-rotor of 30 amps., as compared to the 36 *No-Rotor,* taken on one phase only. This motor will start somewhere around 100 percent of full-load torque. When the locked-rotor gets down around 24 or 25 amperes, the starting torque will get up around 150 percent or better. A locked-rotor of 18 or 20 amperes will usually show a starting torque as high as the maximum torque. These figures are approximate, but they represent the average motors. The locked-rotor is very rarely more than the *No-Rotor* amperes, taken on one phase, and very seldom less than 50 percent of the *No-Rotor* amperes. With a locked-rotor reading of less than half *No-Rotor,* unless it is a very special motor, look for rotor trouble, open or loose bars or connections. A variation in the ammeter or wattmeter readings while turning the rotor will quickly indicate bad rotor connections.

The rated full-load speed of the motor often gives an approximate idea of the starting torque. The above motor with a locked-rotor of 33 amperes would probably have a full load speed of 1760 rpm.; 30 amps., 1740 rpm.; 24 amps., about 1720 rpm. At less than that the speed might be down as low as 1600 rpm. From this we can see that locked-rotor readings, when compared to *No-Rotor* readings, can be a very good rotor check.

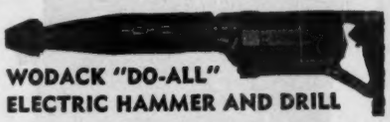
Winding Changes

A *No-Rotor* ampere reading is a check on every phase of a stator winding. If the reading indicates that we

WHERE TO BUY

Equipment, Materials, Supplies and Services for Electrical Construction — Maintenance—Repairs

DRILL CONCRETE THE EASY WAY



WODACK "DO-ALL" ELECTRIC HAMMER AND DRILL

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Telephone AUstin 9866

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for every industrial application

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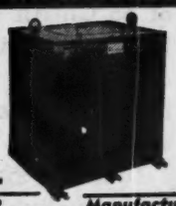

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Successors to Electric Power & Constr., Inc.
569 South Main Street Akron, Ohio

This

WHERE TO BUY

Section

supplements other advertising in this issue with these additional announcements of products and services essential to efficient and economical operation, maintenance and service. Make a habit of checking this page, each issue.

Classified Advertising Division

ELECTRICAL CONSTRUCTION AND MAINTENANCE

will not get the desired results, we can make changes in the winding that will give us the output which we require.

There are a number of factors which affect maximum torque. First is the external connections of the winding. If a single, 2- or 3-phase motor is series-connected, changing this to two-parallel will multiply the maximum torque, and hence the *No-Rotor* reading, by four. A 3-hp. 220-volt, 9-ampere full-load, motor would call for a *No-Rotor* reading of about 50 amperes. If the *No-Rotor* reading is 12 amperes, reconnecting this motor for 2-parallel would give a *No-Rotor* of 4 × 12, or 48 amperes. Changing from 2-parallel to 3-parallel will increase maximum torque in the ratio of 4 to 9, or over 2 to 1. Changing the above winding to 3-parallel would give a *No-Rotor* of about 108 amperes.

Three-phase motors give considerably more variety in possible changes. Ratios of maximum torque values, and *No-Rotor* ampere readings for 3-phase connections are listed in Table III.

Other factors which affect the winding are principal changes in turns, coil pitch, and wire size. Each has a definite effect on maximum torque. Changes due to different turns are made in accordance with the following formula:

$$\text{No. of turns for desired maximum torque} = \sqrt{\frac{\text{present max. torque}}{\text{desired max. torque}}} \times \text{present number of turns}$$

As the maximum torque is proportional to the *No-Rotor* amperes, the same results can be obtained by substituting *No-Rotor* amperes for maximum torque in the above formula. Suppose a motor with a *No-Rotor* reading of 100 amperes (maximum torque of 300 percent) is to be changed to a maximum torque of 200 percent (close to a *No-Rotor* ampere reading of 65). The number of turns for 200 percent maximum torque would then be equal to the square root of 100/65 × present number of turns.

Tables can be developed to show results obtained by making changes in coil pitch.

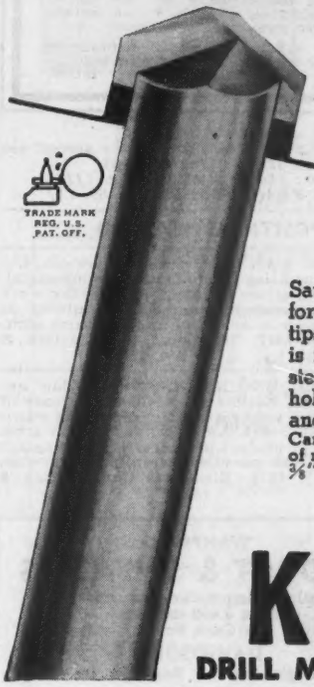
Generally changes in wire sizes affect results somewhat as follows: For each increase in size of wire, maximum torque will be increased about six to eight percent. Starting torque will increase up to twice this amount. Reducing wire size lowers maximum and starting torques by the same amount.

Any change that affects maximum torque in a motor will be directly reflected in a proportionate change in the *No-Rotor* ampere reading. Hence this is a key to many problems.

7½ HOURS SAVED

BECAUSE THE CUTTING EDGE is KENNAMETAL

TRADE MARK REG. U.S. PAT. OFF.



Saving 7½ manhours in one day is typical performance for Kennadrills—the new rotary drills having cutting tips of Kennametal cemented carbide—the metal that is far harder and more durable than the hardest tool steel. No starting punch needed—Kennametal tip takes hold readily, drills fast, retains sharp edge under heat and abrasion.

Can be used in any standard rotary electric drill on all types of masonry. Available in following drilling diameters: ¼", 5/16", 3/8", 7/16", ½", 9/16", 5/8", ¾", 7/8", 1", 1⅛", 1¼", and 1½".

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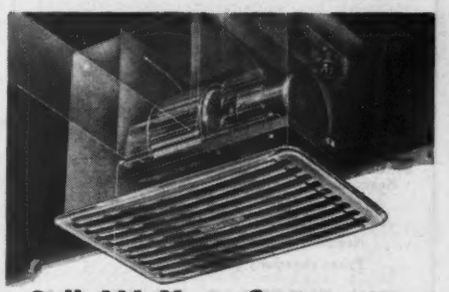

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You can recommend the Clipper for proper kitchen ventilation, and you can quickly install it and forget about it!

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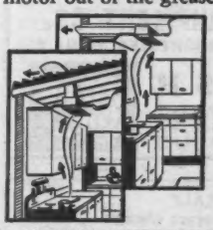
Cash in on this *nationally advertised* ceiling blower. Guaranteed for 5 years because of the exclusive, patented partition which keeps the motor out of the grease-laden air stream.



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(Classified advertising)

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Toggle Switches, single pole		
G. E. cat. # M252	.32	.23 ea.
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. . . PLATES, duplex receptacle or toggle switch, Brass 5¢; BR. Plastic 6¢; Iv. Plastic 9¢; Chrome 11¢.

. . . BX CABLE, (14/2) nationally known brands only, 4.9¢ ft. ($12.25 for 250 ft. coils.)

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SERVICE STATION LIGHTING TECHNIQUES

[FROM PAGE 67]

washing rooms. Decorative lighting is appropriate for waiting rooms and rest rooms.

Pump island lighting. High level lighting is desirable in the service area at pump islands. This is efficiently obtained by pump island reflectors installed on short standards, either plain or ornamental. Two pumps can be lighted with one unit located between, or three pumps can be well lighted by two units, installed between the three pumps, etc., as shown in Fig. 4. Dials on pumps should be lighted from within the pump (Photo B).

Grease pit lighting. Various methods have been used for pit lighting. One of the most successful techniques consists of recessing special pit lighting units in the pit wall (Fig. 2). Some units are designed for flush installation in the wall, while others are recessed in the wall niches and made adjustable for directing the light upwards at the correct angle to light the under side of the car. Explosion-proof type units should be used in any pit which is considered a hazardous location. Handy floodlights mounted on portable bases are also sometimes used.

Hydraulic lift lighting. Special heavy duty cast housing units designed to be recessed in the floor, and equipped with heavy impact-resisting glass, provide good illumination for auto lifts. Two units are recommended for wheel type lifts (Fig. 3), and four units are recommended for axle type lifts. Vapor tight incandescent units are also suitable when installed directly on the lift, about three feet on centers on each side of the lift.

Carefully planned lighting on any service station will attract customers and increase sales. With competition as keen as it is in this field, good lighting is an asset that will pay for itself many times over. Even "regular" customers change their buying habits, and a clean, attractive well-lighted station will do much toward keeping old customers, and influencing new customers away from other stations which are less attractively lighted.

Each service station presents its own problems for a successful lighting solution. The problems involved on each station should be carefully analyzed, and then the techniques best adapted to create a high attracting power, a decorative treatment, and plenty of well diffused light for attendants and mechanics, should be selected and used.

EQUIPMENT NEWS BRIEFS

[FROM PAGE 88]

into the same case with standard watt-hour meters. . . . A new group of low-current **indicating lamps** has been added to the line manufactured by the H. R. Kirkland Co., Morristown, N. J. . . . . Globe Lighting Products, Inc. of New York, has announced a new **fluorescent lighting fixture,** known as KG-300-40. It takes an individual spot SP-003 and is available in suspension, flush, continuous flush and continuous suspension.

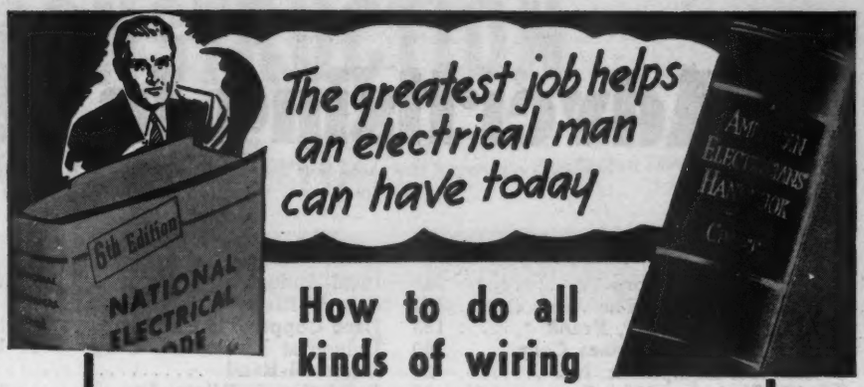
Rostan Corporation, New York, has introduced Trig Towers, "packaged" **aluminum towers,** designed for all purpose use by the communications, electronic and electrical fields. . . . A new industrial type **circulator,** known as Model M-351 Man Cooler, has been introduced by the Fresh-nd-Aire Company of Chicago. . . . New England Carbide Tool Company, Cambridge, Mass., announces the Blue Cyclone **hammer bit** for drilling granite.

A new precision **gravity-feed oiler** for solid bearings where an accurate rate of feed and filtered oil are essential, is being manufactured by Trico Fuse Mfg. Co., Milwaukee, Wis. . . . Beaver Pipe Tools, Warren, Ohio has announced the new No. 77 **adjustable threader,** made especially for power drive use. . . . **Rotol,** a new liquid formula that cleans all forms of electrical contacts has been introduced by the Rotol Chemical Co., Elmhurst, L. I., N. Y.

The Simplytrol indicating and controlling pyrometer is a thermocouple type **control** for furnaces, ovens, kilns. It is manufactured by Assembly Products Inc., Chagrin Falls, Ohio. . . . Portable Electric Tools, Inc., Chicago, Ill. announces a new Hi-Power Model 77 **electric drill kit** consisting of a ¼ inch portable electric drill and ten high-speed drills. . . . **Slimline fluorescent lampholders,** designed especially for use of slimline lamps using a variable range of wattages and current values from 100 to 300 milliamperes have been developed by Kulka Electric Mfg. Co., Inc., Mt. Vernon, N. Y.

A new one-man **hoist** with "Pow'r Pull" has been introduced by the American Gage and Manufacturing Company of Dayton, Ohio. . . . Superior Instruments Co., New York, N. Y. has announced a new pocket-size volt-ohm-milliammeter Model 770. This **tester** has been designed for the radio serviceman and electrical appliance serviceman. . . . Tomic Sales and Engineering Company, Detroit, Mich. has presented a new **thinwall fitting,** No. 10 EMT. It is rain-tight and is provided with a stainless steel locking washer, which prevents rust even in a salt atmosphere.

Two new d-c **magnetic multi-pole relays** have been added to the line of machine tool controls manufactured by Square D Company, Milwaukee, Wis.



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